European Region

Higher Education in France and the International Migration of Scientists

Dominique Martin-Rovet, Damien Terouanne, Jean-Baptiste Thibaud, and Elizabeth Neher

The French System of Higher Education

The Current Situation: A French Original

One of the major reasons for the complexity of the French system lies in the dichotomy, unique in Europe, between its universities and the elite *Grandes Ecoles*. This coexistence of two different types of institutions arises from historical circumstances. In the 18th century, the political establishment, which was wary of the Church's power over the university, founded the *Grandes Ecoles* to train the ranks of military and technical personnel needed by the state. In the past, preference was given to one or another of these institutions, depending on the political climate of the country. During the 20th century, however, the increasing importance of technology has slowly but surely turned the *Grandes Ecoles* into the sole route to the highest positions in French government. Institutions designated as *Grandes Ecoles* or simply *Ecoles* have proliferated, especially in the fields of economy and business.

Between 1960 and 1997, the number of students enrolled in higher education rose from 310,000 to 2.1 million. The students are distributed between the *Ecoles* (238 engineering schools, 230 business schools), which select 9.5 percent of the students in higher education; the general university system, which educates 62 percent of the total; technical and technological higher education institutions (*Instituts Universitaires de Technologie, écoles universitaires d'ingénieurs*), which account for 16 percent; and paramedical and social training, which make up the remainder. Both the universities and the *Grandes Ecoles* (with the exception of business schools) are a part of the national public system and free for students.

The Universities. University education is divided into three cycles.

1. The first cycle (equivalent to freshman and sophomore years of college) leads to the *Diplôme d'Enseignement Universitaire Général* (General University Diploma) in 2 years.

2. The second cycle leads to the *licence*, equivalent to a bachelor or arts degree and 1 year of study toward a master's degree.

3. The third cycle leads to a higher level professional degree (*Diplôme d'Etudes Supérieures Spécialisées* in 1 year) or a doctoral degree.

The *Grandes Ecoles*. One of the great advantages of the *Grandes Ecoles* in engineering and business is the quality of their student population. Most of these schools pick their students through competitions, primarily among candidates from *Grandes Ecoles* preparatory classes. This educational track, over 2 or 3 years, attracts the best students from the best high schools. The *Ecoles* offer better conditions, with smaller class sizes and better equipment and facilities (computers, classrooms, laboratories) than most universities. The cost to the government is significantly higher: $12,500 per student per year, as opposed to $5,900 in the standard first cycle.

Finally, the graduates of the *Ecoles* are able to find professional employment much more easily than their contemporaries from the university system, due to an education aimed at a particular goal, the contacts they made with the business world during their educational career, and their alumni networks.

A System in Crisis

At the University. A large number of students fail during the first, general, cycle: 34 percent drop out in the first year, and only 28 percent successfully complete the 2 years. In addition, the degree awarded does not lead to any particular professional position.

The quality of instruction in the universities suffers in part due to the system used to evaluate the professors, which looks at research and scholarly publications. A diploma does not necessarily make employment easier to find, since public service is no longer the major outlet for graduates, and the private sector does not value the degrees. The business world and the needs of the high-technology sector of the economy are, in their turn, not well understood by the universities.

University research suffers also from a lack of means, coordination, and links to the private sector. The university administration is inefficient and does not have enough autonomy. It cannot recruit the technical personnel it needs. The different faculties and the engineering schools within the universities guard their independence jealously.

Unlike the *Grandes Ecoles,* which can be selective, the universities are required to accept all candidates. In practice, legal (e.g., limited space in the medical schools) or illegal means of selection control recruitment. University diplomas, which are theoretically all supposed to have the same value and which are awarded by the state without reference to a particular university site, are, in fact, ranked on the job market according to campus.

In the *Grandes Ecoles*. The percentage of students in the engineering *Grandes Ecoles* went from 14 percent of total engineering enrollment in 1900 to 3.7 percent in 1997. Selection has become more and more rigorous, and the student population more and more unbalanced. Most of the students are from the families of government officials and corporate executives. The majority of those participating in the competitions for the most elite schools (*Ecole Normale Supérieure*, *Ecole Polytechnique*) come from only about 10 high schools.

The mostly theoretical instruction provided does not always leave enough time for less theoretical work, for innovation, or for work on specific projects. Ideas necessary to the vitality of business, like intellectual property rights and human rights, are not always addressed in sufficient detail. Students are not always trained in scientific research and its methods. Finally, there is insufficient external evaluation of the education and the degrees.

Counseling at the universities is scarce, so the students depend primarily on other information sources when making choices. In the *Grandes Ecoles,* those choices are most often guided by the reputation, rather than by the content, of the studies. The nature of the two styles of instruction is converging as the universities become more industry-oriented. With the disappearance of its *raison d'être*, the difference between the two is gradually becoming less apparent.

Proposed Reforms: Reorganizing the French Educational System for the 21st Century

In this period of increased economic competition, market forces sweeping the professional world cannot ignore higher education. But the logic of the marketplace, already at work in some countries, brings with it monetary discrimination and a growing gap between a few elite institutions where quality comes with a very high price tag, and a large, more or less mediocre, system for the vast majority of students. In France, this trend in higher education would eliminate equal access to education, one of the foundations of the republic.

The French system of higher education has been in existence for almost 1,000 years. As in almost every other country in the world, it is faced with three major challenges: the growth of its bureaucracy, the diversification of knowledge and skills needed, and the increasing costs of education.

With most European countries confronting these questions, this is a particularly propitious time to inaugurate reforms. A commission appointed by Prime Minister Lionel Jospin has just released a report on the subject.[1] This paper summarizes the report's principal conclusions.

Redefining the Missions of Higher Education. Higher education should allow each student to identify his or her individual strengths and to pursue studies in different disciplines by increasing contacts and connections between the different university departments.

Currently, researchers in public institutes such as the National Institute of Health and Medical Research (INSERM) and the National Committee for Scientific Research (CNRS) are not required to teach; university professors conducting research have been able to spend much of their time in their laboratories, since it has always been the quality of their research that is used to

[1]"Toward a European Model of Higher Education," report of the commission presided over by Jacques Attali, STOCK, May 1998.

evaluate them. All publicly funded researchers, in both the institutes and the universities, must be required to spend more time in the classroom.

Education should combine formal training for business and technology with the transmission of cultural appreciation (literature, philosophy, humanities) and general knowledge. It should encourage the faculty to strive for innovation.

Continuing education must take its place in the system of higher education. It must award diplomas with the same value as those of regular university degrees by allowing students to alternate between periods of work and study. It must allow the unemployed to receive training that is useful in the job market.

The system should also provide means for students from more modest backgrounds, who tend to pursue studies that are technically oriented, to switch to educational tracks that are more academically and intellectually inclined by creating more bridges between the two tracks.

Another goal would be to emphasize a global perspective and encourage integration with the European Community's educational system. This might be achieved by offering all students in higher education a term of study abroad and by accepting the best foreign students and instructors into the French school system. It would require improving recruitment, using English for some subjects, easing the bureaucratic procedures for recognizing diplomas from other countries, harmonizing the curricula with those of the other countries of the European Union, and—finally—adopting the European Union's evaluation criteria and procedures.

New Principles of Organization—National Level. France's system of higher education needs to become more coherent in setting curricula, levels of degrees, and geographic distribution of its campuses. Campuses must be located near the emerging centers of excellence, the *Pôles Universitaires Provinciaux* consisting of the best university and *Grandes Ecoles* departments in a region (including the campuses of neighboring countries) linked in networks. These "university centers" will have a common teaching and research orientation.

Each university center will need to establish more regular contractual relationships with the state, allowing the center more autonomy. These relationships will be based on a campus plan and quadrennial contracts, which will allow the universities more initiative in defining their academic offerings.

As a reasonable balance to this increased autonomy, a regular evaluation of the strengths and performance of each campus or university department will influence its financing. To this end, the creation of a new *Agence Supérieure d'Evaluation* has been proposed, which would be outside the authority of the Ministry of National Education. Academic evaluation would be conducted by peers.

Evaluation of professors would take teaching abilities into account. It would initiate a system of student evaluations and incorporate them into reviews of the instructors. The professors would have to be able to relocate, and there would be greater possibilities for mobility in posts. A pay scale that would be more responsive to merit while providing better salaries would accompany these new requirements.

New Principles of Organization—Local Level. As in an urban community, these campuses of higher education must organize themselves under a single administration, sharing materiel and human resources, creating a comprehensive curriculum, and encouraging exchanges between establishments. Entrepreneurial enterprises must be encouraged on these campuses through the availability of capital risk funding, especially in the fields of software engineering, biotechnology, and materials. Career advancement and continued education via alumni associations must be expanded to include the entire campus.

Reforming the Curricula. The curricula must be reworked to facilitate transfers between the universities and the *Ecoles*, and the degrees must be more equivalent to those awarded in other countries. The primary objective would be to make all new diplomas have a recognized value in the job market and lead to real careers.

In the universities, university education would be divided into:

- A *licence* in 3 years, consisting of individually accumulated credits, allowing each student to mix studies and work. The first semester would be aimed at choosing a major; the last year, including a term of work-study, would have a general professional orientation. Class sizes would be reduced by using secondary school instructors. Technological education would follow the same schedule.

- A new *maîtrise* in 2 years after the *licence* would serve to further a particular major course of study. The second year would be dedicated to an individual research program or to subjects that would complement the major field.

- A doctoral program 5 years after the *licence*, called *Ecoles Doctorales*, would offer the option of taking the *maîtrise* exams after 2 years. It would include multidisciplinary studies, career counseling, and more interaction with industry. Research would start earlier in the curriculum than is currently the case.

The first 3 years of medical studies would be grouped with biological sciences, resulting in a new biomedical *licence*. Limitation in the number of enrollments would not commence until after the *licence*. A doctorate in medicine would take the same amount of time as in other disciplines and would be open to students from other scientific fields.

This plan, called "3-5-8," is more or less parallel to the American system of higher education given the fact that, in France, high school lasts 1 year longer than in the United States.

In the *Grandes Ecoles*:

- Preparatory classes would be phased out once the changes had been made in the first university cycle. The entrance exams would change so as to open enrollment in the *Ecoles* to students following technology tracks.

- While remaining an elite track for technical training, the *Grandes Ecoles* would grant the *licence* at the end of the first year, and the new *maîtrise* at graduation.

- The monopoly held by the *Grandes Ecoles* in filling government posts will be ended.

Conclusion

Financing all these reforms, especially the lengthening of the first university cycle, will require a significant national effort. But demographics indicate that the population entering the universities will be falling, and the proposed regrouping will realize savings as well. Fiscal and regulatory measures should encourage business and regional governments to join in this effort.

Without requiring uniformity of systems, the countries of Europe should standardize their curricula and diplomas within a new framework that is neither bureaucratic nor strictly independent. The European Union still needs to define a policy for higher education; this could be one of its major tasks in the next decade.

Doctorate and Postdoctorate

Focus on the French Doctorate

France, with its long tradition of higher education, produces a considerable number of Ph.D.s. In fact, it produces a higher percentage of doctors per million inhabitants than any other industrialized country.

Table 1. Ph.D. theses per million inhabitants

Country	Number of theses		Population (millions)	Theses per million inhabitants
Australia	(1993)	1,803	17.7	102
Canada	(1993)	3,356	29.0	116
Denmark	(1992)	512	5.2	98
France	(1995)	9,800	58.5	168
Germany	(1993)	12,400	81.0	153
Great Britain	(1994)	8,300	58.0	143
India	(1987)	4,177	*(est.)* 700.0	6
Italy	(1998)	2,400	57.0	42
Japan	(1993)	12,000	124.5	96
Mexico	(1990)	269	86.2	3
United States	(1994)	41,011	260.0	158

SOURCE: French Ministry for National Education, Research and Technology (MENRT), 1997.

Given that France ranks fourth in research and development (R&D) budget, after the United States, Japan, and Germany, and fifth in the publications world share after the United States, the United Kingdom, Japan, and Germany, its influence in science education is remarkable. Its success is also due to a conscious national effort over the past 10 years to improve and expand its higher education establishment.

Between 1989 and 1997, the number of Ph.D.s awarded doubled from 6,000 to 12,000. The following table shows this growth through the year 1996. All disciplines demonstrated this strong growth. The social sciences and humanities represent almost one-fourth of the Ph.D.s awarded. Physics and chemistry and the life sciences were also popular.

The proportion of women receiving Ph.D.s reached 36.8 percent (42.3 percent of French and 25.4 percent of foreign recipients) in 1996. These numbers increase steadily but vary greatly from one scientific discipline to another. In the life sciences, more than half of the Ph.D. recipients are women. The percentage is also high in the social sciences, law, and physics and chemistry. The lowest percentages are observed in mathematics, computer sciences, and engineering.

Funding for graduate studies has traditionally come from the Ministry for Education, Research and Technology. It allocates grants for 3 years, allowing the student to complete the research for a thesis. This program was begun in order to shorten the number of years spent on preparing a thesis, which could take as many as 7 to 10 years. This 3-year period does not include the 2 years of the third cycle after the French *maîtrise*, which is devoted to classes.

The doubling of the number of degrees has had a great deal to do with the difficulty facing students who graduate with a *maîtrise* when they start looking for employment. The unemployment situation has had an impact too on the type of funding available. Since 1996, ministry scholarships have been granted to no more than 28 percent of all students. Foundations and corporations fund more than one-third of the total. Nearly 1 in 10 Ph.D. students have to support themselves by working. A full 28 percent of the graduate students have no scholarships or reported income whatsoever. This is a source of great concern.

It is important, nonetheless, to emphasize that this situation varies greatly from discipline to discipline. More than half of the students in the social sciences and hu-

Table 2. Ph.D.s awarded from 1989-96

Disciplines	1989	1990	1991	1992	1993	1994	1995	1996
Total	5,963	6,782	7,198	8,585	9,295	10,602	9,801	10,963
Mathematics	198	233	247	296	356	418	364	426
Physics and chemistry	1,378	1,466	1,537	1,897	1,940	2,168	1,943	2,148
Geosciences	328	335	313	418	410	439	453	499
Computer and information sciences	810	868	903	1,029	1,085	1,176	1,237	1,342
Life sciences	1,223	1,436	1,409	1,664	1,843	1,972	1,882	1,999
Social sciences and humanities	1,017	1,256	1,425	1,746	2,006	2,540	2,197	2,414
Law	545	621	706	832	908	1,071	906	1,139
Engineering	464	567	658	703	747	818	819	996

SOURCE: French Ministry for National Education, Research and Technology (MENRT), 1997.

Table 3. Percentage of women who received Ph.D.s, 1992-96

Disciplines	1992	1993	1994	1995	1996
Total	31.9	33.1	35.1	34.9	36.8
Mathematics	17.5	18.7	16.5	20.5	20.9
Physics and chemistry	31.0	32.8	34.2	34.5	39.5
Geosciences	24.6	28.0	37.8	34.5	32.1
Computer and information sciences	17.6	16.1	20.3	20.1	19.9
Life sciences	45.9	47.2	51.8	51.0	50.7
Social sciences and humanities	41.2	43.6	42.7	41.2	44.7
Law	31.2	32.0	33.1	30.4	36.0
Engineering	14.8	14.6	13.7	16.6	18.3

SOURCE: French Ministry for National Education, Research and Technology (MENRT), 1997.

manities have no funding or insufficient resources. By contrast, around 90 percent of the students in physics and chemistry, computer sciences, life sciences, and engineering are fully funded.

Of positions overseas, 46.3 percent are in North America. It is the most favored destination for those in the life sciences and engineering. The European Union (other than France) is now in second place, after North America, with 41.3 percent of positions abroad, compared to 40.2 percent in 1995. More than one young Ph.D. in two in physics and chemistry opts for a position in a European Union country. Japan attracts only 3.2 percent of the postdoctorates going abroad. All other countries combined attract 7.8 percent.

Table 4. Origin of funding for Ph.D.s awarded in 1996

Disciplines	Scholarships from the MENRT	Scholarships from other sources	Salaries	No funding	Total
Total	2,936	3,521	964	2,919	10,340
Mathematics	141	137	27	116	421
Physics and chemistry	755	999	80	216	2,050
Geosciences	227	183	15	39	464
Computer and information sciences	478	617	77	117	1,289
Life sciences	684	711	213	340	1,948
Social sciences and humanities	181	197	377	1,363	2,118
Law	197	164	126	595	1,082
Engineering	273	513	49	133	968

SOURCE: French Ministry for National Education, Research and Technology (MENRT), 1997.

The Postdoctorate

The postdoctoral position was not common in France before the 1970s. Most scientists found employment in the university or in the public research institutes. Ph.D.s led, almost automatically, to permanent government positions. Today, tight budgets and increased numbers of graduates have moved the threshold at which scientists can find such employment to a more advanced stage of their careers. In addition, the internationalization of science has made a postdoctorate in another country highly desirable. There is also almost no financing available in France for French postdoctorates. Therefore, more and more French Ph.D.s are having to seek postdoctoral positions abroad.

Until now, it has been impossible to deal with this situation in France with any kind of concerted national effort, since the status of postdoctorate implies a lack of permanence. French law and French unions are opposed to the permanent creation of temporary positions for French citizens. Foreigners, however, are not covered by these limitations.

An estimated 1,900 or more Ph.D.s actually took postdoctoral positions after defending their theses in 1996. As in the 3 preceding years, two-thirds of the postdoctoral positions are located abroad. The exact proportion is 66.7 percent. Only 350 French Ph.D.s pursued postdoctoral terms in France, compared to 400 the previous year.

North America (the United States and Canada) is still the preferred destination for postdoctorates this year.

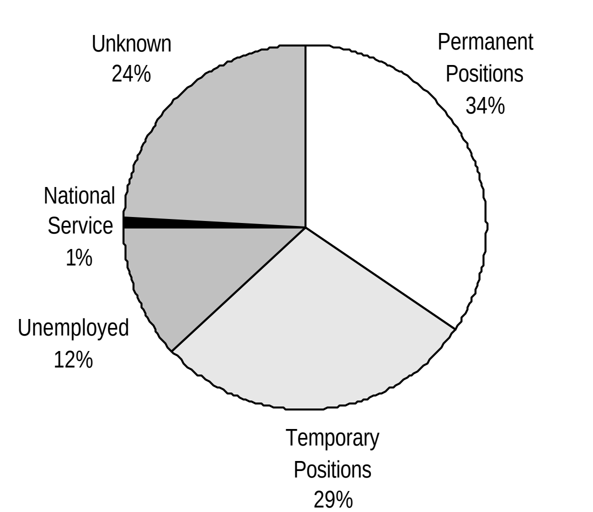
A postdoctorate in France lasts at least 2 years. More than one in eight postdoctorates will eventually stay in the country offering the postdoctoral position: 103 postdoctorates (73 French and 30 other nationalities).

Employment for Scientists

Two years after getting their degrees in 1996, 34 percent of Ph.D. recipients have found permanent employment. Another 29 percent have found temporary positions, and 12 percent are still unemployed. The remaining 24 percent did not respond to a request for information. This, of course, renders extensive interpretation dubious. The general tendencies shown by the responses, however, confirm the experienced judgment of researchers in the field.

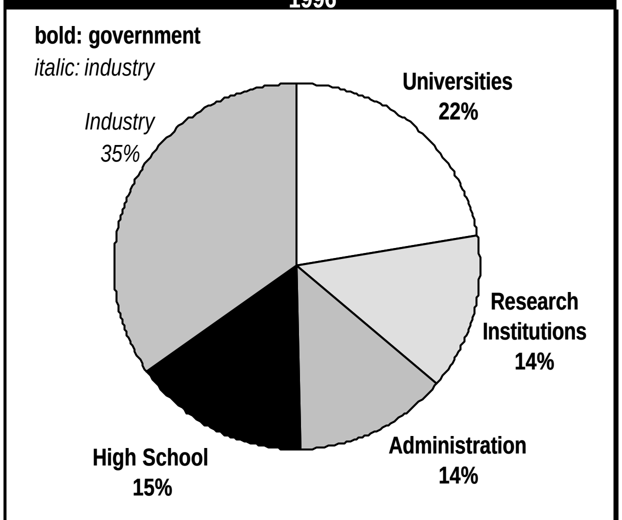
Of the permanent positions offered to the 3,559 Ph.D.s, 65 percent are with the French government: 22 percent work as assistant professors, 14 percent serve as research scientists in public institutions, 15 percent teach in high schools, and 14 percent work in the administration. Only 1,246 found jobs in industry.

Figure 1. Professional positions held by the 10,340 Ph.D.s who got their degrees in 1996



SOURCE: French Ministry for National Education, Research and Technology (MENRT), 1997.

Figure 2. Permanent positions held by 3,559 Ph.D.s in 1996



SOURCE: French Ministry for National Education, Research and Technology (MENRT), 1997.

This means that out of more than 10,000 Ph.D.s per year, only 12 percent find jobs in industry, and less than one-fourth were able to follow the traditional path of French doctoral recipients by finding permanent government positions. The number of positions in industry is an estimate based on survey responses and confirms the perception in France that industry does not recruit a significant percentage of Ph.D. recipients. In France, the largest employment sector is small business. However, high-tech small businesses are scarce, and the large industrial firms are still recruiting the majority of their professional workforce directly after graduation from the *Grandes Ecoles*. This situation is one of the reasons young French scientists come to the United States (see last section of this paper).

Foreign Students in France

General

France has always been one of the favorite destinations of immigrants from the rest of Europe, from Africa, and more recently from Asia. Immigrants come to France when migrating to the West, and also when migrating from the former French colonies. The French educational system is one of the major attractions. In 1996-97, there were 1,449,129 students in French universities, of which 125,205 (8.6 percent) were foreigners. For the past 10 years, this percentage has declined slightly. In 1985-86, 13.6 percent of the entire student population came from other countries.

Half of the foreign student population comes from Africa; they are evenly distributed among all the sciences and humanities. Twenty-nine percent come from other European countries, and show a marked preference for the humanities and social sciences. Just 2,774 students (2 percent) come from the United States to study in France. Nearly all of them take liberal arts and social sciences. Only 100 pursue courses in science and engineering (S&E).

Doctoral Students

The distribution of students by region of origin at the doctoral level shows approximately the same proportion as that of all foreign students in French universities.

That same year (1996-97), there were 2,807 doctoral degrees awarded to foreign students, representing 27.1 percent of all doctorates awarded that year. The proportion of foreign degree recipients was 1.2 percent

Table 5. Foreign students in French universities 1985-96

Foreign Students	1985	1989	1991	1992	1993	1994	1995	1996
Number of foreign students in thousands...	132	132	137	138	140	134	130	125
% of foreign students..................................	13.6	11.8	11.2	10.7	10	9.4	8.9	8.6

SOURCE: French Ministry for National Education, Research and Technology (MENRT), 1997.

Table 6. Foreign students in French universities 1996-97 (by region and discipline)						
Region	Law	Economics	Liberal arts and social science	Science and engineering	Medicine, pharmacy, and dentistry	Total
Total	15,418	16,368	47,033	27,811	18,575	125,205
% foreigners	8.2	10.7	9.1	5.5	12.6	8.6
Europe	5,557	3,905	17,563	6,055	2,736	35,816
European Union	4,394	2,823	13,627	4,443	1,657	26,944
Asia	1,358	1,512	6,451	3,761	3,249	16,331
Africa	7,485	10,392	16,560	16,616	11,937	62,990
Americas	989	527	5,333	1,290	609	8,748
United States	353	59	2,225	104	33	2,774
Brazil	93	71	687	274	94	1,219
Canada	126	67	600	152	56	1,001
Oceania	7	10	95	23	5	140
Stateless	22	22	1,031	66	39	1,180

SOURCE: French Ministry for National Education, Research and Technology (MENRT), 1997.

Table 7. Foreign candidates receiving the French doctorate in 1996		
Country of origin	Number	Percent
Asia	276	9.8
Eastern Europe	136	4.8
Europe	365	13.0
Latin America	261	9.3
Near & Middle East	240	8.6
North Africa	1,015	36.2
North America	53	1.9
Sub-Saharan Africa	399	14.2
Other	62	2.2

SOURCE: French Ministry for National Education, Research and Technology (MENRT), 1997.

lower than in 1995, although the proportion of Europeans remained the same at 18.4 percent. All scientific disciplines were affected by this slight reduction. At this level too, more than half of the degree recipients in 1996 came from Africa. Even now, Europeans tend to pursue doctorates in their own countries. Nearly 10 percent come from Latin America. This relatively high number reflects the fact that France is a traditional refuge for immigrants seeking political asylum from these countries. Latin Americans prefer France as an alternative to the United States and Spain.

Mathematics attracts the highest percentage of foreign students pursuing doctorates, although the highest number of students is found in the humanities and social sciences. Physics and chemistry attract the next highest number.

The rate at which foreign students return to their countries of origin has dropped slightly; half of them do go home in the 18-month period following their thesis defense.

Table 8. Distribution and rate of return of French Ph.D.s of foreign origin (1997)				
Disciplines	Number of foreign doctors	Percentage of all doctors	Number of returns to country of origin	Percentage of returns to country of origin
Total	2,807	27.1	992	35.3
Mathematics	161	38.2	42	26.1
Physics and chemistry	500	24.4	196	39.2
Geosciences	149	32.1	52	34.9
Computer and information sciences	366	28.4	91	24.9
Life sciences	345	17.7	125	36.2
Social sciences and humanities	633	29.9	244	38.5
Law	343	31.7	121	35.3
Engineering	310	32.0	121	39.0

SOURCE: French Ministry for National Education, Research and Technology (MENRT), 1997.

Postdoctorates

Postdoctoral positions have not been the norm in France; scientists have always been employed by the government in the past, and the temporary nature of postdoctoral positions has been alien to employment policy. The Anglo-Saxon experience with the benefits of postdoctoral work in a different scientific environment has, however, won over the French scientific community. Funding programs and positions have not yet been established enabling French labs to hire French nationals in large numbers as postdoctorates. Funding does exist for them to hire foreign nationals. Every year, about 500 new foreign postdoctorates find employment in French labs.

The proportion of foreigners at the postdoctoral level has greatly decreased. In 1995, this group still accounted for 38 percent; in 1996, it was down to only 22 percent foreigners. The percentage of postdoctorates returning to their own countries is between 35 and 50 percent by the end of 2 years.

Young French Scientists in the United States[2]

Each year, American universities receive 450,000 foreign students. This number, which might seem high, actually represents no more than 3 percent of the total population of students in the United States in all years of study. For comparison, about 9 percent of the students in the French university system come from other countries.

Despite this disparity in percentages, the United States, which is the world leader in R&D, has a reputation for being very attractive for students and scientists worldwide. It is only through more detailed analysis that it is apparent that the number of foreign students in the United States is especially high in science and engineering. That percentage increases with grade level. Almost half of the foreign students in the United States are in S&E. While only 3.7 percent of the bachelor's degrees (the American equivalent of the *licence*) awarded in S&E go to foreign students, that percentage climbs to 24 percent at the master's degree level (*troisième cycle*), and reaches 39 percent among doctorate-holders.

France only ranks 16th in terms of the number of its citizens enrolled as students in American universities. Among the 8,000 doctorates in S&E awarded each year to foreign students in the United States, only about 100 go to French citizens. This means that there are no more than 500 French citizens currently pursuing their doctorates in American universities.

The attraction of American R&D, however, is not limited to university studies. Many doctors come here for postdoctoral positions (postdoctorates) in American laboratories. Among scientists from countries like France, which has an excellent system of public education, it is much more common to seek experience in the United States at the postdoctoral stage than during the university career. The problems encountered in the past few years by young doctorate-holders when they seek to enter the French workforce have only served to exaggerate this tendency. The data presented in this report confirm that today there are *at least twice as many postdoctorates as doctoral candidates in the population of French citizens who are identified as being involved in science and engineering and are currently in the United States*.

These young scientists, who demonstrated their intellectual excellence during their university careers, and who often sought a postdoctorate appointment in the United States as something that would enhance their chances of one day finding employment as staff in a French university or public institution, represent the population commonly defined when speaking of a "brain drain." A closer look at the situations of these French postdoctorates in the United States and at their aspirations shows that they tend more toward being temporarily overseas, with plans to return eventually to France, than permanent expatriates.

This section looks at the physical presence of French scientists and engineers in the United States using data obtained from the National Science Foundation (NSF) and other American institutions. It is supplemented with the results of a survey of French doctoral candidates and postdoctorates in North America conducted by the CNRS Washington office.

[2]This section is based on American data and is excerpted from Damien Terouanne, *French Presence in the United States in Science and Technology* (Arlington, VA: National Science Foundation, forthcoming).

The data available from American government agencies and other institutions made it possible to study separately four populations that constitute the French presence in the United States:

- people born in France, having a college or graduate degree in science or engineering obtained either in the United States, France, or elsewhere, who are counted as permanent residents of the United States;
- scientists and engineers moving to the United States each year for professional or other reasons;
- French students enrolled in American universities; and
- French students pursuing a Ph.D. in an American university.

That last population is a subgroup of the third category, but since the data about the two groups were of both different origin and nature, a separate presentation was deemed preferable.

French Citizens With Bachelor's or Graduate Degrees Living in the United States

The data presented in this section came from NSF's SESTAT Integrated File database, which contains the results of three surveys conducted among people with college or graduate degrees *living as permanent residents* in the United States. The data used for this current study concern persons born in France, less than 76 years old, with a bachelor's or graduate degree obtained either in this country or elsewhere, living in the United States at the time of the 1990 census.

Throughout this part of the study, therefore, we are looking not at the movement of a group of people, but at a permanent population of French citizens living in the United States having a college or graduate degree. The first findings look at all degrees—S&E as well as all other majors. The figures on those with S&E degrees are then studied in greater detail.

Four levels of degrees are considered: the bachelor's (baccalaureate +3 in France); the master's (baccalaureate +5 or 6); the Ph.D. (doctorate); and professional degrees (law degree, medical degree, etc.). Only the first three degrees apply when analyzing the S&E population.

The fields comprising S&E are:

- the physical sciences;
- the life sciences, including the Ph.D. in medicine;
- the social sciences, including psychology;
- mathematics and computer science; and
- engineering.

General Findings. In 1990, the United States census counted 31,400 permanent residents born in France with college or graduate degrees. Of those surveyed, 71.3 percent had obtained their highest degree in the United States, 23.7 percent had obtained it in France, and 5 percent received their highest degree in other countries.

Among those surveyed, 57.9 percent studied or graduated from high school in the United States, with 35.5 percent having completed secondary school in France, and 7 percent in other countries. Of that population, there were 8,960 with degrees in S&E, 28.6 percent of the total.

There were 2,810 French citizens with a doctorate from an American, French, or other institution who were counted as being permanent residents of the United States in 1990. The origin of their doctoral degrees is as follows:

- 920 French doctorates—33 percent,
- 1,830 American doctorates—65 percent, and
- 60 from a third country—2 percent.

Persons With Degrees in S&E: Country in Which They Received Their Secondary and Higher Education. Of those 8,960 French citizens surveyed in the United States in 1990 having a degree in S&E, most received their entire secondary education in the United States or finished their secondary education there (59 percent); an even higher percentage (74 percent) obtained their highest degree in the United States (see tables 9 and 10).

Table 9. Country in which French citizens living as permanent residents in the United States, with degrees in science and engineering, received their secondary education

Disciplines	Secondary schooling						
	France		United States		Other		Total
Total	2,662	30%	5,267	59%	1,026	11%	8,955
Engineering	573	26	1,292	58	344	16	2,209
Life sciences	528	27	971	49	483	24	1,982
Math and computer science	324	33	655	66	16	2	995
Physical sciences	203	38	168	31	167	31	538
Social sciences	1,034	32	2181	68	16	0	3,231

SOURCE: National Science Foundation, Division of Science Resources Studies, Scientists and Engineers Data System (SESTAT) Integrated File, 1993.

Table 10. Country in which French citizens living as permanent residents in the United States, with degrees in science and engineering, received their graduate degrees

Disciplines	Highest degree obtained in:						
	France		United States		Other		Total
Total	2,045	23%	6,649	74%	260	3%	8,954
Engineering	303	14	1,784	81	122	6	2,209
Life sciences	569	29	1,412	71	0	0	1,981
Math and computer science	255	26	740	74	0	0	995
Physical sciences	65	12	335	62	138	26	538
Social sciences	853	26	2,378	74	0	0	3,231

SOURCE: National Science Foundation, Division of Science Resources Studies, Scientists and Engineers Data System (SESTAT) Integrated File, 1993.

Some variation by discipline is evident among the general trends. For example, of the French citizens having their highest degree in engineering, 81 percent were either entirely educated in the United States or finished their degrees in the United States. On the other hand, only 62 percent of those with degrees in the physical sciences pursued or finished their studies in the United States.

At all levels of education, French citizens with degrees in S&E and living in the United States as permanent residents were more often educated in the United States than in France.

Influence of Secondary Studies in the United States on Choice of Discipline. The data in table 9 allows a concentrated look at the population of French citizens in the United States with degrees in S&E who completed their secondary education in the United States. The degrees obtained by these 5,270 individuals are distributed as follows:

- 25 percent in engineering (1,290 diplomas),
- 18.5 percent in the life sciences (970 diplomas),
- 12.5 percent in mathematics and computer science (655 diplomas),
- 3 percent in the physical sciences (168 diplomas), and
- 41 percent in the social sciences (2,181 diplomas).

For the purposes of comparison, degrees awarded in the United States in S&E (bachelor's, master's, and doctorates together) over the last 20 years are distributed in about the same way:

- 21.2 percent in engineering,
- 16.6 percent in the life sciences,
- 12.0 percent in mathematics and computer science,
- 7.2 percent in the physical sciences, and
- 43 percent in the social sciences.

One conclusion naturally arises from the similarity of these distributions: French citizens who obtain their secondary education in the United States tend to follow the same paths in college and graduate studies as their American counterparts.

Country in Which the S&E Degree Was Obtained, by Level of Degree. If we look at the country in which the highest diploma was obtained by level of degree (bachelor's, master's, Ph.D.), one trait is immediately apparent: the proportion of French diplomas in S&E increases with level of degree. Most of those surveyed who have a bachelor's degree (or equivalent) as their highest level diploma obtained that degree in the United States (figure 3). This means that few French citizens who come to the United States with a college education do not pursue a higher degree. At the master's stage, 30 percent of those surveyed have a French diploma. The proportion is as high as 48 percent among those with doctorates.

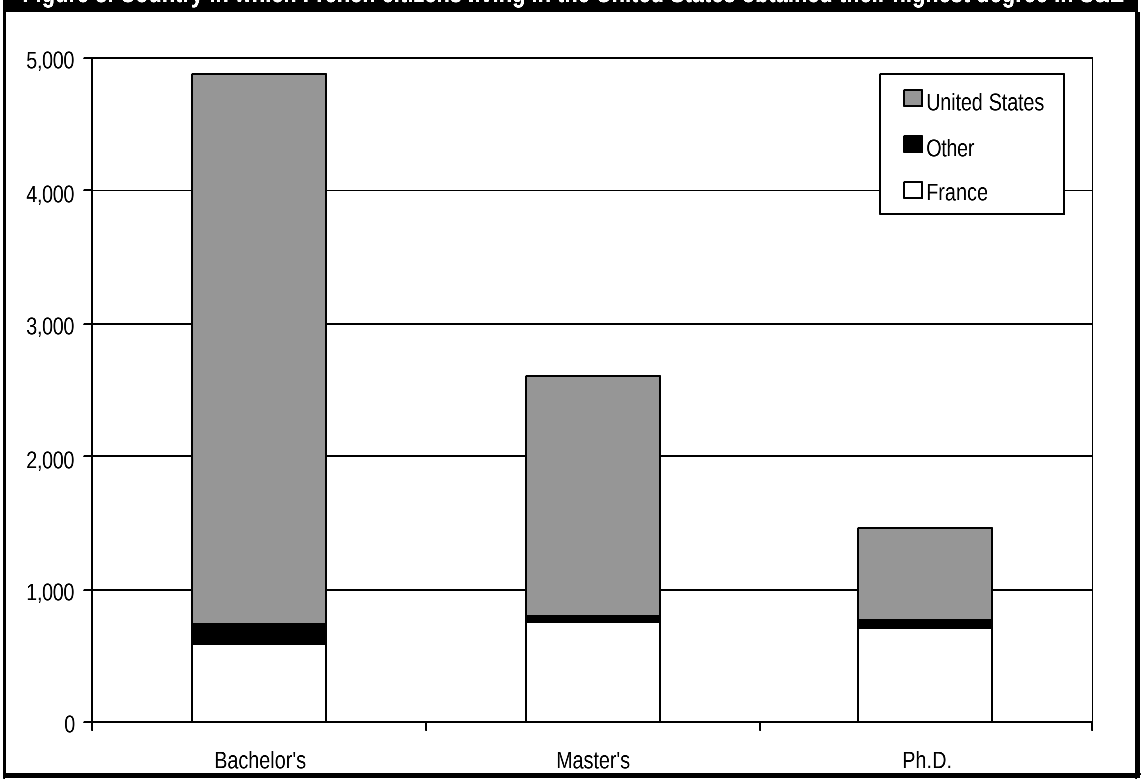
French S&E Ph.D.s in the United States. There were 1,470 French citizens with a Ph.D. from the United States, France, or elsewhere surveyed in the United States in 1990. Their distribution by place of origin of their diplomas was:

- 710 doctorates from France (48.5 percent),
- 700 doctorates from the United States (47.5 percent), and
- 60 doctorates from third countries (4 percent).

Putting aside the question of the place of origin of these degrees, it is interesting to look at the distribution by specialty (figure 4) and to compare it to the distribution of doctorates awarded by American universities (figure 5). Between 1980 and 1993, doctorates in mathematics and computer science comprised only 6 percent of all doctorates in S&E awarded in the United States. However, 19 percent of French S&E doctorate-holders living in the United States as permanent residents were in those disciplines.

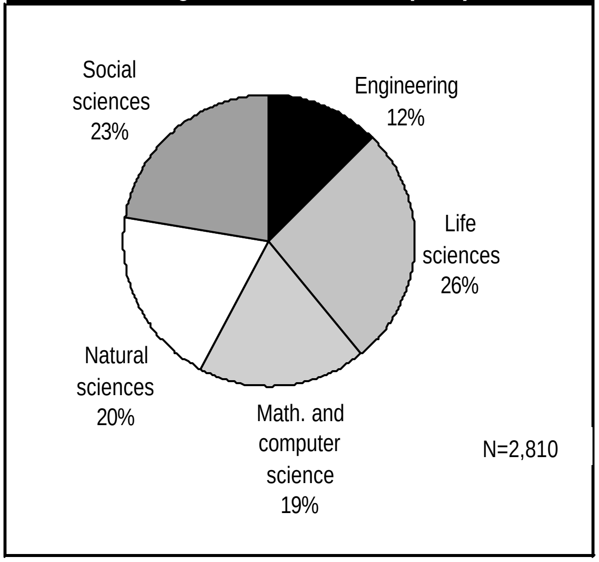
Another significant difference appears in the field of the social sciences, which represents 32 percent of the American S&E doctorates but only 23 percent of doctorates obtained by French citizens living in the United States as permanent residents.

Figure 3. Country in which French citizens living in the United States obtained their highest degree in S&E



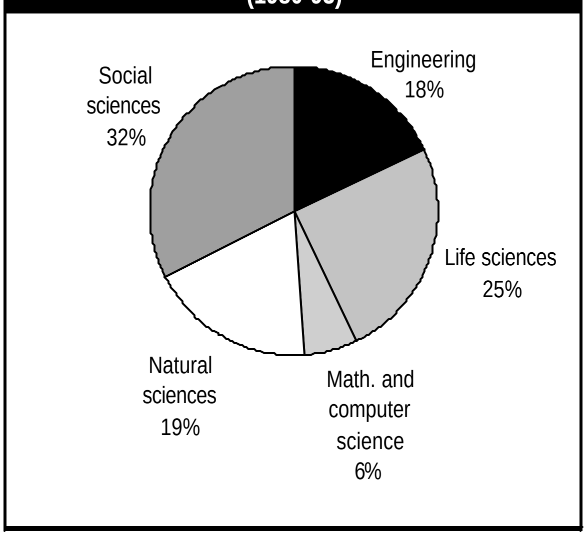
SOURCE: National Science Foundation, Division of Science Resources Studies, Scientists and Engineers Data System (SESTAT) Integrated File, 1993.

Figure 4. Doctorates held by French people living in the United States (1993)



SOURCE: National Science Foundation, Division of Science Resources Studies, Scientists and Engineers Data System (SESTAT) Integrated File, 1993.

Figure 5. S&E doctorates awarded by U.S. universities (1980-93)



SOURCE: National Science Foundation, Division of Science Resources Studies, Selected Data on Science and Engineering Doctorate Awards, 1996.

Conclusion. Most of the 9,000 French citizens living permanently in the United States and having a graduate degree have pursued their secondary education in the United States, and three-fourths of them obtained their highest level diploma there. However, when looking at only those with the highest level degrees, the trend is reversed. Among those 1,500 S&E doctorate-holders, almost half have French doctorates. *Of all the persons educated in France, those with doctorates represent the highest proportion of those who are "lost" to France.*

Migration of French Scientists and Engineers to the United States

The data used in this section were obtained from the U.S. Immigration and Naturalization Service (INS), the department charged with regulating immigration. An immigrant is an alien admitted to the United States as a legal resident. The INS provided NSF with data on those immigrants who declared themselves to be scientists or engineers, and whose curriculum justified that designation. Those who declared themselves to be researchers, managers, teachers, or students were not included in the figures. Neither were those who did not declare a profession. Therefore, the following figures are perforce underestimates of the actuality.

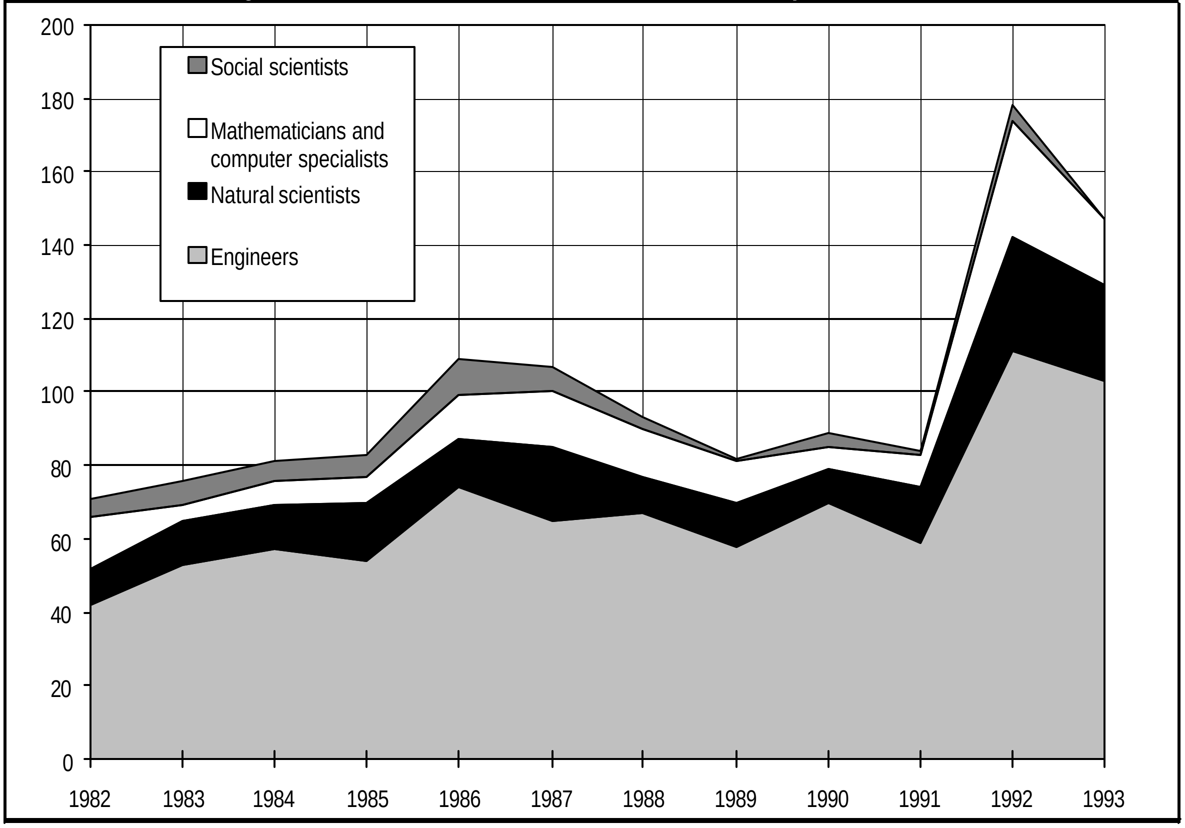
It is important to note, also, that among the French immigrants in S&E are some who have lived in the United States for several years, but on temporary visas. They may have, for example, obtained a doctorate or filled a postdoctoral position in the United States, but they will not appear in the figures from immigration until they become permanent residents.

French Scientists and Engineers Admitted to the United States as Permanent Residents. Figure 6 shows the number of French scientists and engineers admitted to the United States on permanent visas since 1982. Only those persons who declared themselves as belonging to one of the four professional categories appear in the figure.

A significant increase is readily apparent in 1992. This was the year the Immigration Act, passed in 1990, took effect. It put into place the first major changes in immigration quotas in 25 years. This law raised immigration quotas for professionals, bringing a strong increase in the number of highly qualified immigrants—among whom are engineers and scientists. (Note that the year 1992 shows as a plateau in figures 6 and 7, due to the 1990 Immigration Act.)

Scientists and Engineers Admitted to the United States Whose Last Country of Residence Was France. In this category, it is not country of origin that is chosen but country of last residence (figure 7). Of the engineers and scientists coming from France to the United States, many are French citizens and were included in the previous subsection analysis. In 1990, for example,

Figure 6. French S&E admitted to the United States on permanent visas



SOURCE: National Science Foundation, Division of Science Resources Studies; U.S. Department of Justice/Immigration and Naturalization Service, unpublished tabulations.

140 scientists and engineers came to the United States from France, and 82 of them were French citizens. That same year, 89 French scientists and engineers were registered by the INS. Seven of those, therefore, came from a country other than France. Additionally, 58 engineers and scientists who were not French citizens left France in 1990 for the United States.

Status of Scientists and Engineers From France: Work Permits. Generally, persons immigrating to the United States for professional reasons, as well as temporary, non-immigrant, workers, must obtain a labor certification from the U.S. Department of Labor. Approximately one person in three comes to the United States for professional reasons; the other two-thirds come because of family or as refugees. One in three immigrants here for professional reasons is exempted from the need for a labor certification. This exemption is most often awarded to highly qualified people, including scientists.

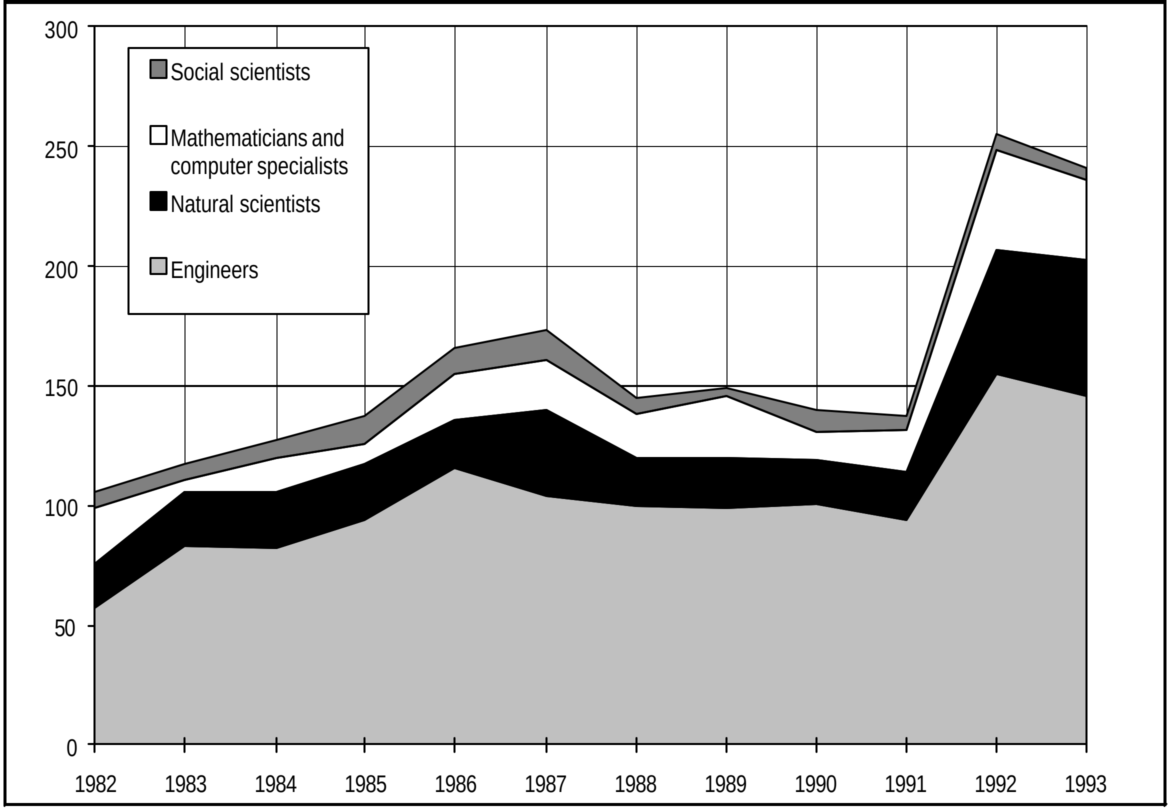
Among those scientists and engineers coming from France, only some immigrate for professional reasons; of those, not all are required to obtain a labor certification. These considerations explain the data in figure 8.

Geographic Origin of Scientists and Engineers Coming From France but Not French Citizens. Each year, scientists and engineers who are not French citizens leave France for the United States. The INS counted between 60 and 80 of them every year between 1984 and 1993. These figures are certainly underestimated, once again due to the number of immigrants whose professions are unknown. With this understood, it is still interesting to look at their distribution according to country of origin.

Figure 9 gives the aggregate of this distribution over the years 1984-93. The evolution of this distribution over time is not different enough to be significant. Overall, the scientists and engineers who lived in France before emigrating to the United States came from the Near and Middle East, the Far East, and Africa.

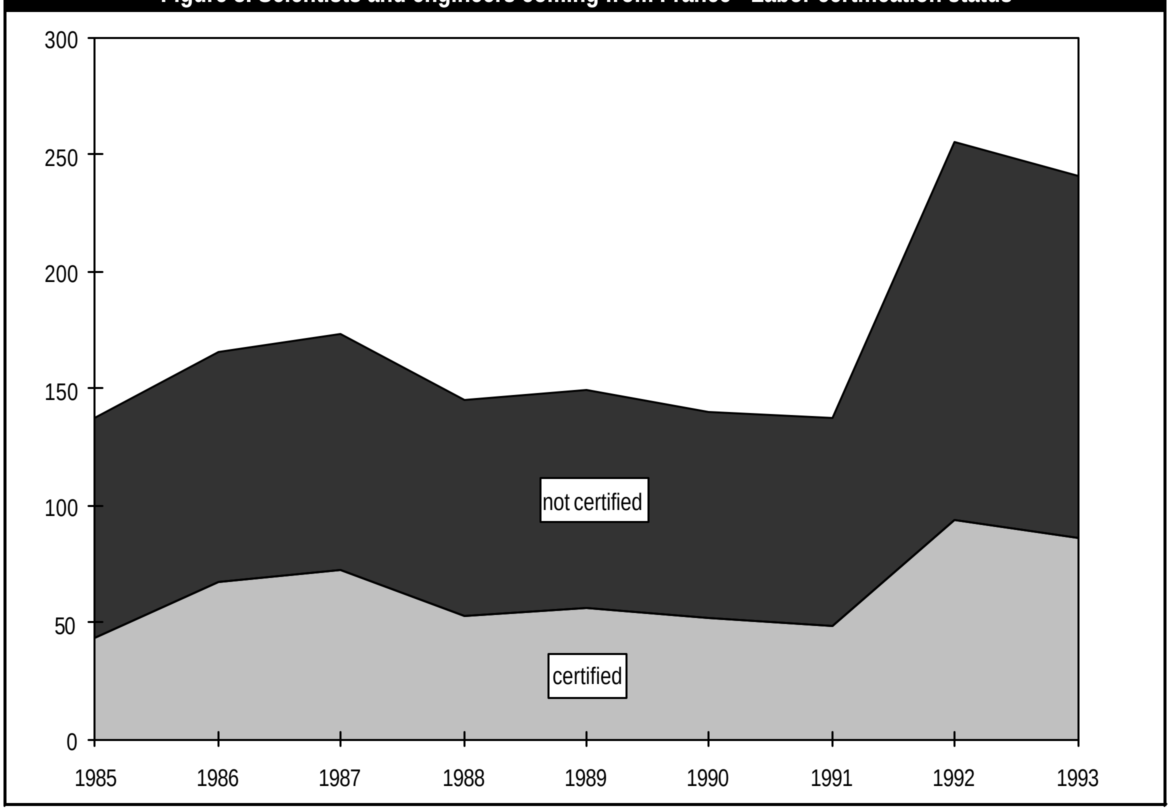
It is instructive to look at the parallels between this distribution and that of country of origin of noncitizens obtaining doctorates in France in 1995 (figure 10). Obviously, it is not advisable to make too much of this comparison because the two figures do not compare the same population. Still, it is interesting to see that Africa, which is the point of origin of more than half the noncitizens

Figure 7. S&E admitted to the United States on permanent visas, last permanent residence is France



SOURCE: National Science Foundation, Division of Science Resources Studies; U.S. Department of Justice/Immigration and Naturalization Service, unpublished tabulations.

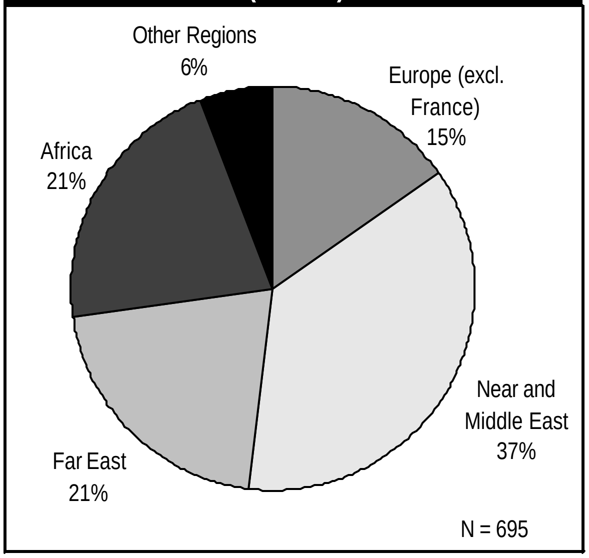
Figure 8. Scientists and engineers coming from France - Labor certification status



SOURCE: National Science Foundation, Division of Science Resources Studies; U.S. Department of Justice/Immigration and Naturalization Service, unpublished tabulations.

obtaining doctorates in France, is not disproportionately represented in the population of non-French citizens who are scientists moving from France to the United States.

Figure 9. Origin of non-French scientists and engineers leaving France to the United States (1984-93)



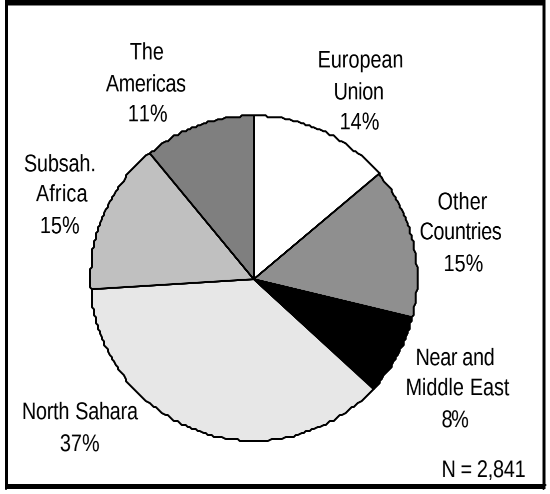
SOURCE: National Science Foundation, Division of Science Resources Studies; U.S. Department of Justice/Immigration and Naturalization Service, unpublished tabulations.

In fact, those scientists coming from the Near East and Middle East, a smaller proportion of those who get their doctorates in France (about 8 percent), leave for the United States in much higher numbers (37 percent of the immigrants coming from France but not French citizens).

French Students and University Staff in American Universities

This section is based on data found each year in the reports *Open Doors* and *Profiles,* published by the Institute of International Education. *Open Doors* presents the results of a yearly survey of the population of foreign students registered in all American universities. Depending on the year, the rate of response of these establishments varies between 90 and 98 percent. Unfortunately, not all the universities reply with the same amount of detail. For example, in the data for 1995-96, the universities registered a total of 453,800 foreign students, but those conducting the survey could only identify countries of origin for 395,000 of them, or 87.1 percent. The level of academic studies is only known for 346,000, or 76.3 percent.

Figure 10. Doctorates awarded to foreign people in France in 1995



SOURCE: French Ministry for Research, DGRT Rapport sur les études doctorales, December 1996.

In *"Profiles,"* universities are asked to furnish data that is individual in nature on their foreign students: nationality, sex, field and year of studies, major source of funding. This request for supplemental detail reduces overall participation. In 1993-94, about 70 percent of the institutions that responded with the number of foreign students provided the individualized information. This data, all together, provided information on a sample population of 258,300 students, 57 percent of the total population counted in that year's *Open Doors*. Finally, of the individual forms filled out, not all were complete, but more than 90 percent had no more than one blank box.

Taking these problems into account, the correlation between the findings of the two surveys is still very strong: the overall distribution by sex, by level and field of study, or by geographic location is very similar in both surveys. It would be reasonable to think that these two sources of data give a fairly representative picture of the population of foreign students, specifically of French students, in the United States.

French Students in the United States: General Trends. There were 5,710 French students in American universities during the academic year 1995-96. This is 2.3 percent lower than the year before. Figure 11 shows the evolution of this number over the past decade. There is a significant increase in the number between 1984-85 and 1990-91, when France went from being the 26th to the 16th in terms of countries having the largest number of students in American universities. Since 1990-91, this population has been stable—between 5,000 and 6,000 students per year. For purposes of comparison, there are currently 8,500 German students in the United States and about 7,800 British students. France ranks third among European countries.

Figure 12 shows the change in the total number of foreign students in the United States since 1984-85. The strong increase between 1984 and 1994 is mostly due to an increase in the number of students from Asia coming to the United States. There were 145,000 Asian students in the United States in 1984-85 (42 percent of the total number of foreign students), and 260,000 in 1995-96 (more than 57 percent of the total). Japan, China, and Taiwan are the most represented countries, each with between 35,000 and 45,000 students in American universities.

The distribution by level of studies of French students in the United States has changed little over time. Following are the figures for academic year 1995-96:

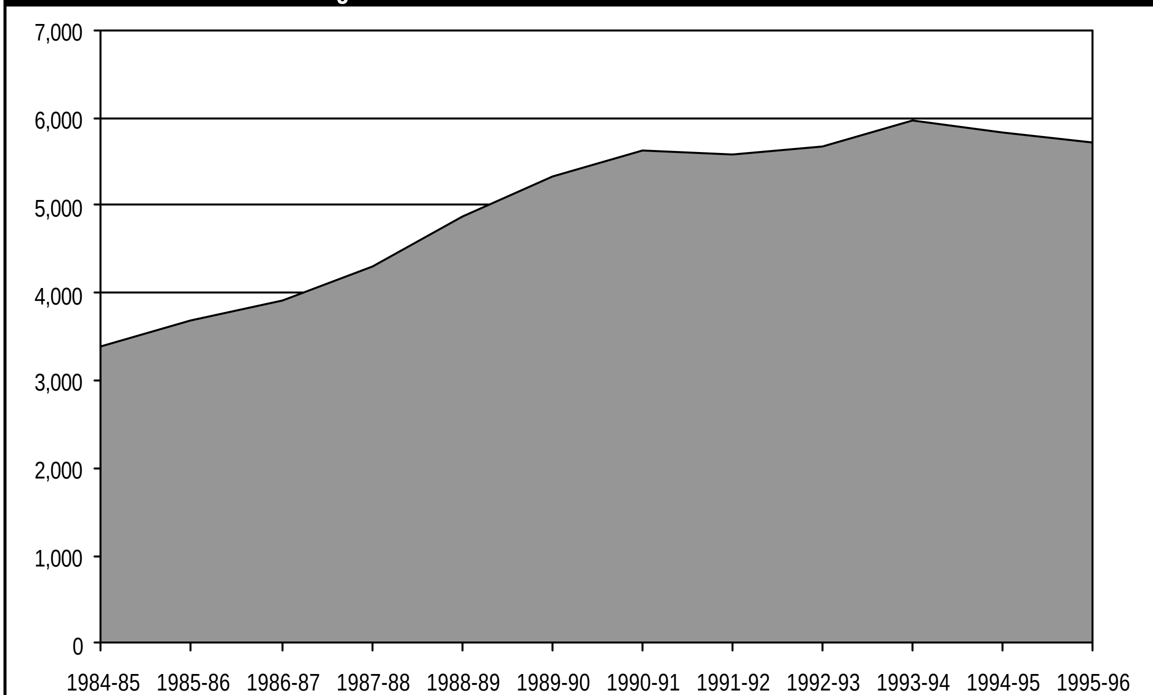
- 2,670 students (46.8 percent) in undergraduate programs (before the *maîtrise* in France);
- 2,340 students (40.9 percent) in graduate programs (after the *maîtrise*); and
- 702 students (12.3 percent) in other programs (intensive English, internships, etc.).

Distribution by Discipline of French Students in the United States. Table 11 gives the approximate distribution of French students in the United States by discipline, based on the findings of the *Profiles* survey of 1993-94. The field of study was known for 2,850 French students, a bit less than half of those counted in the *Open Doors* survey of the same year (5,980).

French Postdoctorates and Scientists at American Universities as Scholars. Despite the lack of precision in the term "scholar," there is a consensus among universities as to how to define this category of person. The definition suggested in the *Open Doors* report is: "International scholars, being neither students nor permanent faculty, conduct research or teach or do both in a concentrated period of time, usually less than three years." The scholar category thus includes people in postdoctoral internships as well as established scientists and academics sent "en mission" for a predetermined length of time in an American laboratory.

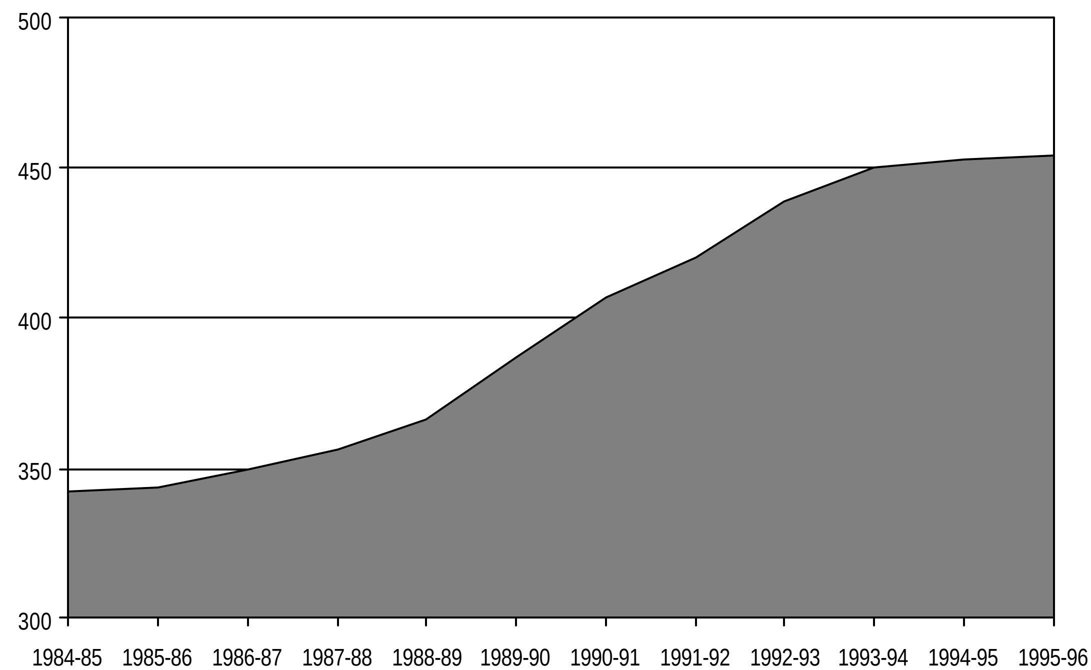
Table 12 gives an idea of the number of scholars counted in the United States over the past few years. Once again, this information comes from a survey of the

Figure 11. French students in American universities



SOURCE: Open Doors - Institute of International Education - Report on International Educational Exchange, years 1984-85 and 1995-96.

Figure 12. Foreign students in American universities (in thousands)



SOURCE: Open Doors - Institute of International Education - Report on International Educational Exchange, years 1984-85 and 1995-96.

Table 11. Distribution by discipline of French students in the United States (1993-94)

Total number of French students counted ("Open Doors")	5,976
Number of students whose discipline is known ("Profiles")	2,845
Percent of Students Whose Discipline is Known	
Commerce - Management	30.8%
Engineering	10.7%
English literature	9.6%
Social sciences	6.6%
Physical and life sciences	5.5%
Beaux-arts	3.8%
Mathematics and computer science	3.0%
Other (<3%)	14.5%
Not indicated	15.3%

SOURCE: "Profiles" - Institute of International Education, Report on International Exchange, 1994-95.

universities, with rates of return each year between 80 and 90 percent. The figures given are thus necessarily slight underestimates of reality.

While France ranks 16th in terms of numbers of citizens in American universities, it ranks 8th in terms of number of scholars in those same universities. This discrepancy is an indication of the strength of French research.

The *Open Doors* report provides information on the types of visas held by scholars, without an indication as to country of origin. Among the 58,000 scholars counted during academic year 1994-95, 76.6 percent held a J1 visa. The U.S. Information Agency office for exchange programs in teaching, research, or education issues this visa. Postdoctorates usually have this type of visa, as well as many of the scientists coming to work in American laboratories. The other type of visa scientists and academics may obtain is the H1 visa; this was issued to 16 percent of the scholars surveyed. This visa is given to highly skilled people or to those who bring a type of knowledge or ability that is not available in the United States.

Table 12. Number of French postdocs and scientists in American universities as scholars

Year	Scholars
1989-90	1,810
1991-92	2,175
1993-94	2,076
1994-95	2,410
1995-96	2,320

SOURCE: "Open Doors" report by the Institute of International Education, Report on International Exchange, 1984-85 to 1995-96.

Unfortunately, it is not possible to isolate postdoctorates from scholars from the figures available in the *Open Doors* report. Despite this, NSF estimates that the total number of foreign postdoctorates in American universities is about 17,300. Among the 58,000 foreign scholars in American universities, only about 30 percent fill postdoctoral positions. The same ratio applied to the French scholars population shows that about 700 French postdoctorates work in American universities. About 60 percent of all foreign postdoctorates in the United States, of any nationality, work in a university. By applying the general ratio of foreign scholars/postdoctorates to the number of French scholars counted, we get a total number of slightly more than 1,100 French postdoctorates in the United States.

Conclusion. American universities take in about 5,800 French students each year. Almost half of them are undergraduates (before the bachelor's degree). Studies in commerce and management attract almost one-third of the French students, and science and engineering only about one-fourth. The available data do not allow us to compare country of origin, chosen discipline, and level of studies. It is, however, reasonable to assume that there would be a much higher percentage of scientific disciplines found at the graduate level (master's and doctorate) among the French students, as is the case for students from many other countries.

The American universities surveyed counted about 2,300 French scholars per year. These scholars are temporary visitors, often holding J1 visas; postdoctorates; academics; or visiting scientists. A minority of scholars are postdoctorates.

Doctoral Candidates in the United States

The data used in this section come from the National Research Council's annual Survey on Doctorate Recipients for NSF and four other federal agencies. The information is collected via questionnaire directly from doctoral candidates just before their thesis defense. While answering the questions is not required of the candidates, most do so, finding no difference between this survey and the other administrative papers they must fill out when they get their degrees. In this way, the rate of response has consistently stayed between 92 and 94 percent over the past 10 years.

Total Number of French Doctoral Candidates in the United States, in All Fields of Study. Figure 13 shows the evolution of the number of doctorates awarded to French citizens in the United States between 1985 and 1995 in all disciplines. This population has remained relatively small, despite having more than doubled in 10 years (117 doctorates in 1995, against 46 in 1985). All categories of doctorates, encompassing those in S&E as well, are included. Distribution by sex has stayed basically the same between 1985 and 1995: about one-third of doctorates are awarded to women (35 percent in 1985, 40 percent in 1990, 32 percent in 1995, and 36 percent on average over the entire period under consideration). If only the S&E fields are examined, the proportion of women receiving doctorates is a bit lower: 23.5 percent between 1987 and 1991.

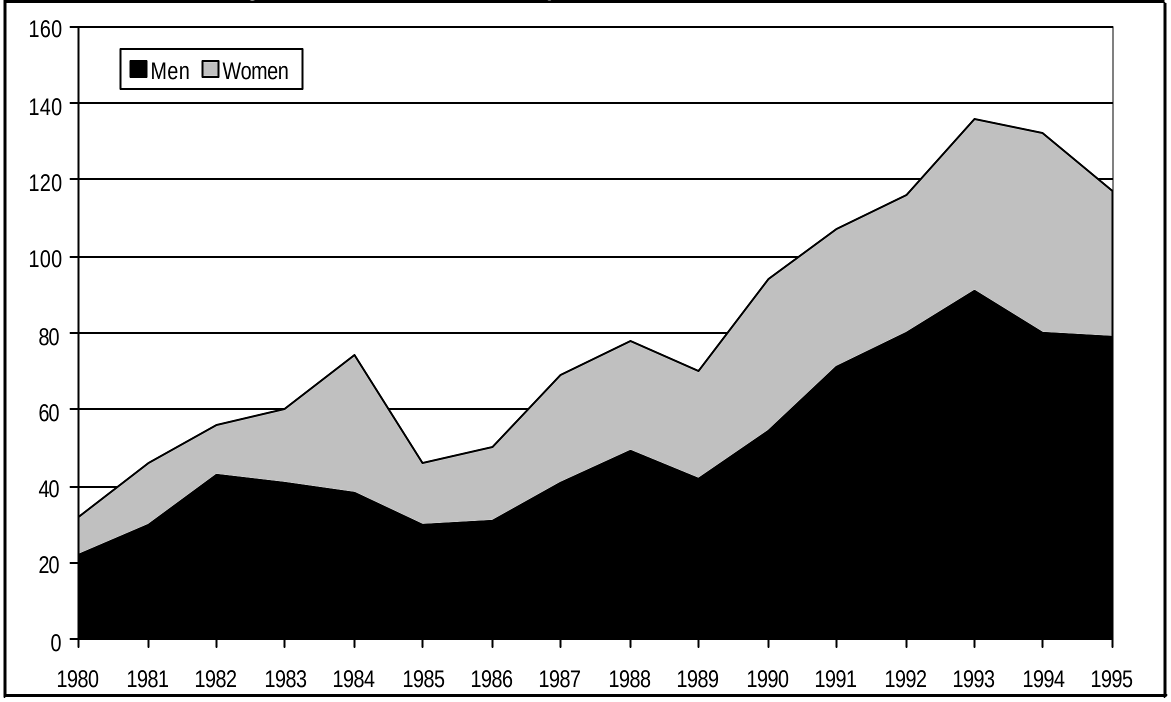
Profile of French Citizens Getting a Doctorate in the United States. Table 13 contains information presenting a profile of the 1,015 French citizens who obtained a doctorate in the United States between 1985 and 1995. During that decade, 30 percent had a permanent visa and were the most likely to remain for long periods in the United States.

The average time between getting a bachelor's degree and obtaining a Ph.D. was 7.4 years. The time spent solely in the university was 6.2 years. These averages are lower than those of all U.S. doctorate recipients in all disciplines, whose average time at the university was 7.2 years, with 10.9 years between getting the two degrees.

The 1-year difference between the university time of French citizens as compared to all doctoral candidates is related to the fact that more French students pursue disciplines requiring shorter terms of university study (engineering, for example, which attracts almost one-fourth of French doctoral candidates in the United States). The more significant difference (more than 3 years) in the total period between the bachelor's and the Ph.D. is due in part to the U.S. practice of alternating work and the pursuit of a degree or of pursuing both work and degree concurrently. The difference between the two groups also shows that French students coming to the United States for a degree do not often adopt this dual regimen; this is mostly due to a lack of opportunity, since most of the students have only temporary visas that do not allow them to work outside of the university environment.

NSF's statistical division—the Division of Science Resource Studies—is responsible for monitoring American activity in science and technology. Therefore, some

Figure 13. Doctorates earned by French students in the United States



SOURCE: National Science Foundation, Division of Science Resources Studies, Survey on Earned Doctorates, unpublished tabulations, 1996.

Table 13. Profile of French citizens who obtained doctorates in the United States 1985-95

All disciplines	Number	Percent
Total number of doctorates (1985-95)	1,015	
Status		
Permanent visas	303	30
Temporary visas	712	70
Average time between the bachelor's and the Ph.D.		
Years since obtaining a bachelor's	7.4	
Years of education since obtaining a bachelor's	6.2	
Married	441	43
Planning to stay in the U.S. after getting their Ph.D	496	49
With a prospective postdoc or job	344	69
Looking for employment or a postdoc	144	29
Not specified	8	2
Science and engineering only		
Number of doctorates in science and engineering	695	
Average age of obtaining doctoral degree	29	
Plans upon receipt of doctorate		
Planning to stay in the U.S.	287	41
Planning to leave the U.S.	274	39
Not yet decided	134	19

SOURCE: National Science Foundation, Division of Science Resource Studies data, Survey on Earned Doctorates, unpublished tabulations, 1996.

of the data available at NSF from the Survey on Doctorate Recipients focus on doctorates in S&E only. An interesting figure is the average age of French recipients of American doctorates, which is 29 years. The average age of all recipients of American doctorates in S&E is 32.2 years. There is the same 3-year difference previously found in the average number of years between the undergraduate degree and the Ph.D.

The questionnaire given to doctoral candidates just prior to their thesis defense includes some questions about their plans. Great care must be taken in interpreting these responses. The French candidates filling out this questionnaire just before defending their theses know that they will need a postdoctoral position if they want to find employment with one of the public sector institutions in France. They are more predisposed, therefore, to see a short-term future in the United States. These findings, moreover, indicate only the *intentions* of future doctorate-holders; they do not actually provide any information on future careers (especially after the postdoctoral period).

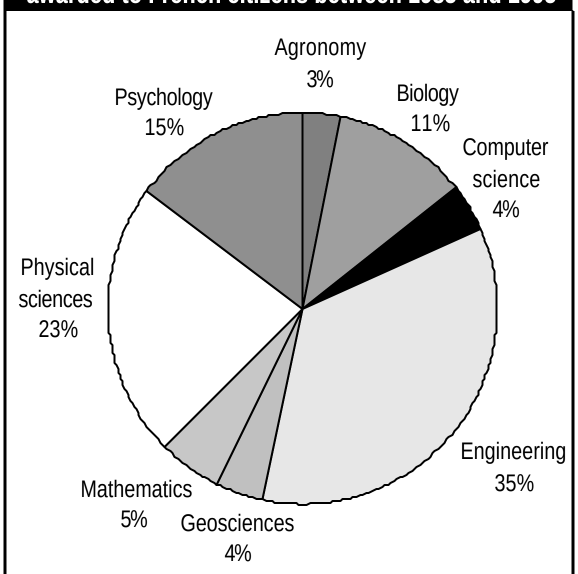
About half (49 percent) of the French doctoral candidates in the United States, in all disciplines, plan to stay in this country after obtaining their degree. Two-thirds of these have a specific position or postdoctoral position arranged. The remaining one-third consists of people planning to stay, but either without specific plans or not stating those plans. In short, some months before defending their theses, one in three French students who are candidates for Ph.D.s at American universities have specific plans to stay in the United States.

In S&E, the proportion of future doctorate-holders planning to stay in the United States, either with or without an arranged position, is a bit lower (41 percent). Details on the nature of these plans or of these persons are not available.

Distribution by S&E Discipline. Between 1985 and 1995, 695 of the 1,015 doctoral degrees obtained in the United States by French citizens were in science or engineering. The distribution of these 695 doctorates by field is given in figure 14. Engineering is an extremely significant field, awarding 240 doctorates—35 percent of the total in S&E. This predominance is recent since only 12 percent of French citizens with doctorates residing in the United States obtained their degrees in engineering (see figure 6). The other field with a large percentage of candidates is the physical sciences (physics and chemistry), which attracts 23 percent of French citizens obtaining their doctorates in American universities.

States and Universities Where French Citizens Come to Study. Two geographic areas are immediately apparent as destinations for French doctoral candidates coming to the United States:

Figure 14. Distribution by field of the Ph.D.s in S&E awarded to French citizens between 1985 and 1995



SOURCE: National Science Foundation, Division of Science Resources Studies data, Survey on Earned Doctorates, unpublished tabulations, 1996.

- California, which awarded almost one-fourth of the doctorates obtained by French S&E students; and

- the Northeastern states, including the Mid-Atlantic (New York, New Jersey, Pennsylvania) and New England (Massachusetts, Connecticut, Rhode Island), which together account for 35 percent of the total.

Table 14. Science and engineering doctorates awarded to French citizens in American universities by state and university (1980-91)

State	S&E Ph.D.s	University	S&E Ph.D.s
Total	505	Total	505
California	117	MIT	32
New York	63	Stanford	31
Massachusetts	52	Berkeley	23
Texas	41	U. of Houston	21
Illinois	30	Columbia University	18
Pennsylvania	23	UCLA	16
Colorado	16	Cornell University	14
New Jersey	14	UC San Diego	13
Connecticut	13	Northwestern Univ.	12
Indiana	13	U. of Pennsylvania	12
Michigan	12	Yale	11
Rhode Island	11	Illinois Inst. of Tech.	10
Georgia	10	Princeton University	10
Other states (<10)	90	U. of Rochester	10
		U. of Texas at Austin	10
		Other universities (<10)	262

SOURCE: National Science Foundation, Division of Science Resources Studies data, Survey on Earned Doctorates, unpublished tabulations, 1996.

These same two geographic areas are found in the survey of doctoral candidates and postdoctorates in North America, the subject of the next section.

Conclusion

Currently, there are 1,500 young French scientists in the United States either pursuing a doctorate or in postdoctoral positions. The often feared brain drain, if in fact it does exist, applies to a relatively small population.

While assembling information from these young scientists, it seems that many of them remain interested in France and want to return there one day for a career in higher education or public research. Their education taught them a love of purely intellectual activity that can be found only in basic research; their early experiences as researchers, as doctoral candidates, and—later—in postdoctoral positions confirmed this preference while also failing to instill an interest in the more applied research that industry offers. This categorical rejection of the value of applied research is often a problem when they seek professional positions—and leads to some bitterness with the French educational system if they have difficulties finding interesting jobs.

While the French university system can be criticized for its lack of interest in the industrial sector, industry shares the responsibility in that it has systematically given preference to students and graduates of engineering and business schools, first in internships and later when hiring.

When stated thus, the problem may seem typically French. The United States, however, is also reexamining the future of its young doctorate-holders and questioning the pertinence of graduate education. In the United States as in France, the educational system does not seem to encourage careers in the industrial sector. The postdoctoral positions are, in the United States, synonymous with uncertainty. The low unemployment rate in the United States makes the problem less urgent.

The gravity of the employment situation in France, even for the best educated, exacerbates the bitterness of these young expatriate scientists. This is particularly evident when those reactions examined in this study are compared to those evinced in the same type of survey 10 years ago. Initiatives such as the *doctoriales*—training designed to help doctorate-holders find employment in the industrial sector—are steps in the right direction. The efforts of the Association Bernard Gregory, whose mission is to find jobs for Ph.D.s in industry; and the activities of the French Office of Science and Technology in Washington that created the Forum USA, an annual job fair at which French scientists in the United States have the opportunity to meet with employers from France in three American cities, will help integrate researchers into the French private sector.

France is aware of this call from its young scientists in the United States. Their futures are tied to the health of higher education, research, innovation, and industry in France. This may be a brain drain, but it is one in which those who have left would like nothing better than a ticket home.

GERMANY

Jeroen Bartelse, Eric Beerkens, and Peter Maassen

INTRODUCTION

Germany has a binary system of higher education, consisting of a university sector and a nonuniversity sector. The university sector is by far the larger, attracting 1.8 million students. The nonuniversity sector is only a quarter this size (Baldauf 1998, p. 162). The basis of the current higher education system lies in the 1960s, but the traditions of earlier times are still very much present in the German doctoral system. Paramount in this respect is the unity of teaching and research.

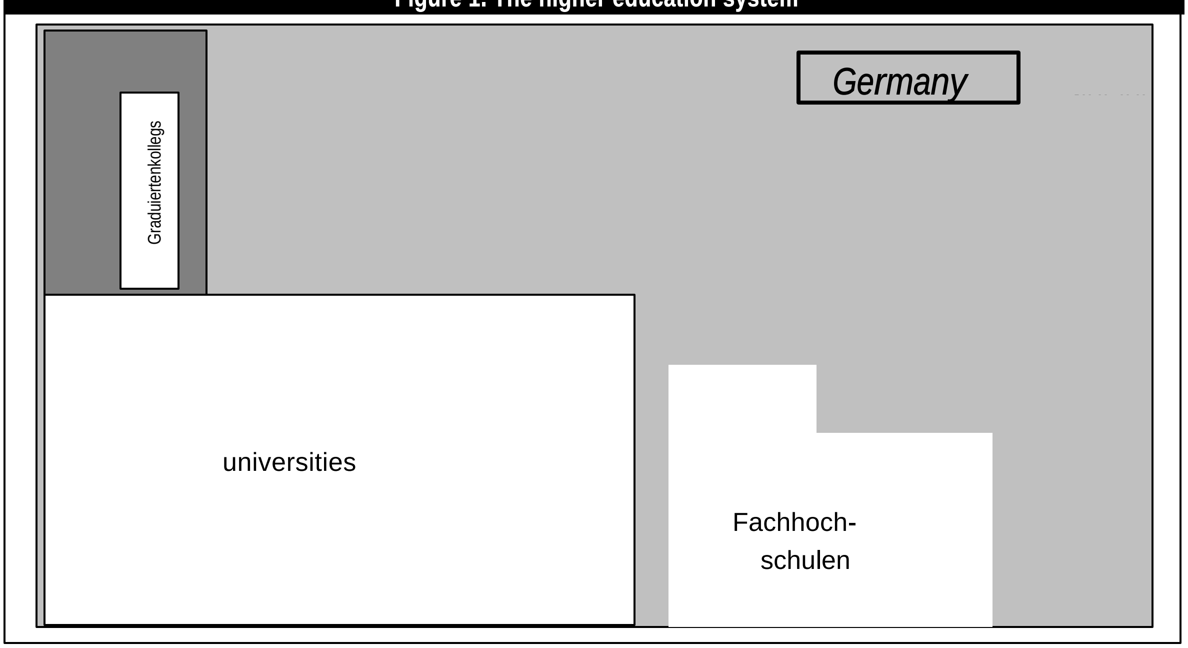
As opposed to the distinction commonly made between undergraduate and graduate studies, German university programs rather are divided into first degree programs and advanced, or postgraduate, degree programs. First degree programs have a formal duration of 4 to 4.5 years and lead to the *Staatsexamen*, *Diplom*, or *Magister*. After obtaining these degrees, graduates can continue their education in two ways: through specialized postgraduate courses leading to a variety of postgraduate certificates or by pursuing a doctorate degree. The doctorate is the highest academic degree in Germany. It can only be offered by universities. Another qualification beyond the doctorate can be obtained, although this is not considered an academic degree in its own right (Kouptsov 1994): the *Habilitation*. The *Habilitationschrift* gives proof of academic scholarship and should comprise a piece of original, independent scholarly work. The holder of a *Habilitation* qualifies for a professorship at a university.

In figure 1, a graphical overview of the German higher education system is presented. In this report, we address the doctoral stage.

TRENDS IN GRADUATE EDUCATION

It was in Prussia in the early 19th century that the idea of research training was grafted onto the context of a university. This began within a broader reform of ideas on teaching, learning, and research. A few high-ranked administrators, influenced by political events in France and by the German idealist philosophers, conceived the idea that a balanced development of state and society was only feasible with educated citizens (Gellert 1993, pp. 5-9). To achieve this aim, the university had to train students for civil jobs, in a neutral atmosphere of truth-seeking. Von Humboldt expressed the ideals of his time into plans for the foundation of a new university. In 1809, the University of Berlin was founded on the basis of Von Humboldt's principles; in the following years, other German universities reformed accordingly.

Figure 1. The higher education system



The ideal of the German university as it emerged at the beginning of the 19th century is summarized by Paulsen (1906, p. 520):

> Its principle was to be, not unity and subordination, but freedom and independence. The professors were not to be teaching and examining State officials, but independent scholars. Instruction was to be carried on not according to a prescribed order, but with a view to liberty of teaching and learning. The aim was not encyclopedic information, but genuine scientific culture. The students were not to be regarded as merely preparing for future service as state officials, but as young men to be trained in independence of thought and in intellectual and moral freedom by means of an untrammeled study of science.

In practice, these principles lent themselves to multiple interpretations (see Clark 1995, pp. 21-24). The orientation toward research led to increasing specialization and gradual departmentalization of universities into centers of specialized research. In the course of the century, the original Humboldtian doctrine with its broad humanistic orientation evolved at some places into a narrow intellectualism: an over-commitment to the advancement of knowledge (see Gellert 1993, pp. 9-11).

The institutional forms that were created for the advancement of science and breeding of scientists were the teaching-research laboratory and the research-oriented seminar (Clark 1995, pp. 24-30). The classic case of the first form is the laboratory of the chemist Justus Liebig, founded in 1826 in Giessen. Here, Liebig combined research and teaching in a way that attracted many advanced students with whom he was able to create a research environment in which innovative research was conducted. Its success motivated other German research universities to review their own training methods. Morrell (1990, pp. 51-64) points out that "the university laboratory provided for science an equivalent of the Renaissance artist's studio, in that it offered to apprentices induction into the scientific guild through pupilage in practical skills under a master-practitioner."

Another form in which research activity was combined with teaching was the research-oriented seminar. The classic and exemplifying model here is the Neumann seminar in physics established in Königsberg in 1834. Unlike other seminars of those times, Franz Neumann included "practical exercises in techniques of quantification, group review of problems, and innovative design of instruments" (Clark 1995, p. 27). The laboratories (later named "research institutes") and seminars were autonomous, relatively small, organizations headed by the chair-holding professor. These influential figures ran the institutes and seminars and were sovereign in their scientific pursuit. The institutes and seminars gave the German higher education system its esteemed reputation in the late 19th century.

The origins of German research training as described in the foregoing section have of course undergone substantial changes in the first half of the 20th century. Rapid industrialization, two world wars, and the transformation of an elite into a mass system of higher education are only a few examples of circumstances with a high impact on the higher education system. However, some of the original beliefs and institutions are still vital and reflected in doctoral training and research.

Freedom of learning has remained the paramount feature of German education and research, anchored in the Basic Law of 1949, which reads: "Art and science, research and teaching, are free."[1] Still surviving is the unity of teaching and research, which is expressed profoundly in the apprenticeship model of doctoral research: the *Doctorvater* who, in a one-to-one relationship, guides his student by way of learning by doing. The institutes form a distinct organizational characteristic of the German higher education system. Influential chair-holders function at the top of these hierarchically ordered organizations, where many doctoral candidates conduct their research. Furthermore, the seminars still exist, although they have been watered down to large-scale instructional seminars at the first degree level rather than at the doctoral level.

After World War II and up until the 1990s, individuals aspiring to a doctoral degree usually sought a junior research post. In 1989, 70 percent of doctoral candidates were employed in this way. Doctoral candidates in these positions combine their research work with teaching and other activities: this, on the one hand, provides them with professional experiences and skills; on the other hand, it lengthens completion times (Baldauf 1998). Research training at the doctoral level is not formally organized. German universities in the 1980s did "not offer doctoral programmes incorporating a minimum systematic institutional effort to qualify candidates further. It is entirely a matter of the individual master/apprentice relation between the candidate and 'his' supervisor whether he gets training and advice in his work and, if so, how much" (Huber

---

[1]Article 5, par. 3, as reported by Clark (1995), p. 52.

1986, p. 302). Enders (1996, p. 165) concludes that, in the 1990s, courses are increasingly being offered (for up to 50 percent of the junior staff working on a doctoral thesis), but that candidates usually perceive doctoral study as an informal learning process. In this respect, there are considerable differences across disciplines.

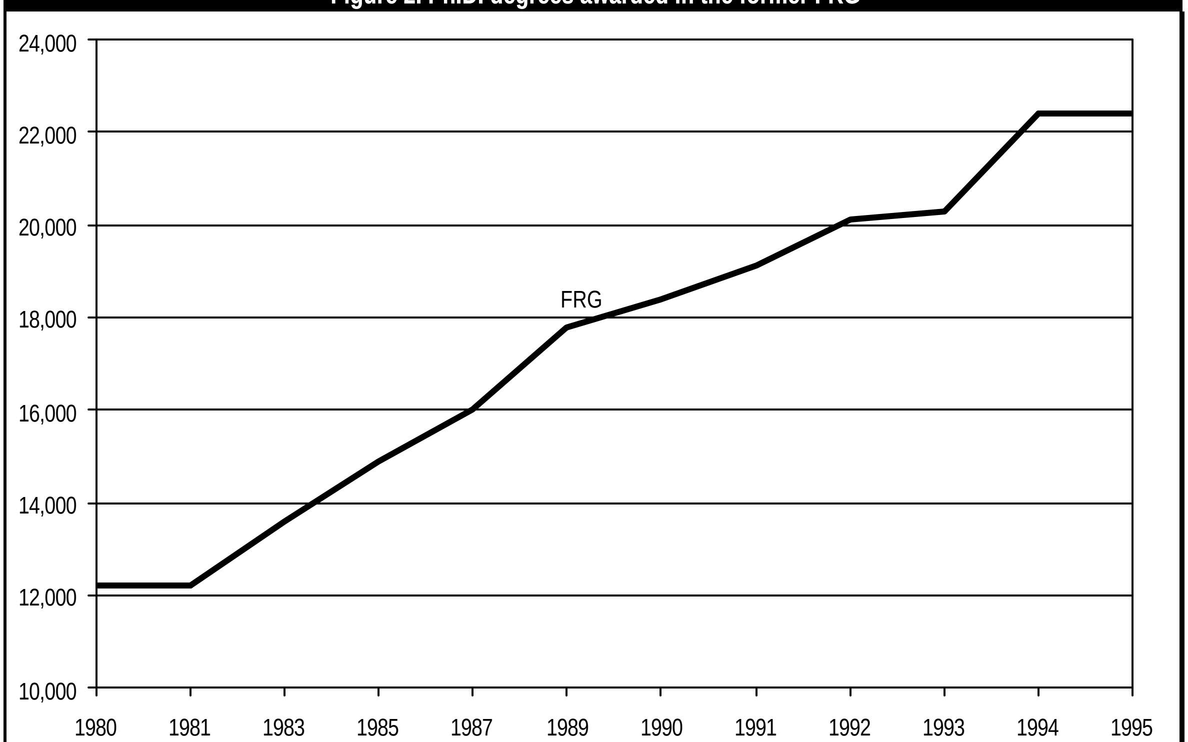
In the natural sciences, junior research posts are relatively numerous as (external) funds are more affluent. Those pursuing advanced research training usually participate in a research group at a university laboratory or an institute. These groups provide a more structured research environment. In addition to the one-to-one apprenticeship relationship, a larger group of researchers provide the doctoral candidates with the opportunity to interact more frequently and to find collegial support in their work. In this context, doctoral colloquia are commonly organized to give doctoral candidates the opportunity to present their work. Those working on a Ph.D. thesis in the social sciences and particularly the humanities miss such a research environment. Moreover, their supervision is often scant. These doctoral candidates "have little contact with universities or their supervisors; they mostly work at home" (Gellert 1993, p. 20).

The following figures show quantitative trends in German doctoral education. Note that only earned degrees are recorded in German statistics on doctoral training. Figure 2 shows the number of doctoral degrees awarded in the former Federal Republic of Germany (FRG). In figure 3, the number of awarded Ph.D. degrees are shown for the FRG, the former German Democratic Republic (GDR), and these two areas together (after 1994, these two areas are not presented separately in German statistics). Figure 4 presents the proportion of Ph.D. graduates in the various disciplines. Figure 5 shows the proportion of female Ph.D. graduates.

Doctoral Reforms

Basically, three broad developments have given an impetus to change to the German system of doctoral education (see Enders 1995,[2] pp. 247-51). First, degree programs were considered overloaded in terms of student numbers and years of study. In particular, the desire to educate students capable of doing scientific research was shifted from first degree programs to a more structured doctoral stage. Second, doctoral education itself was con-

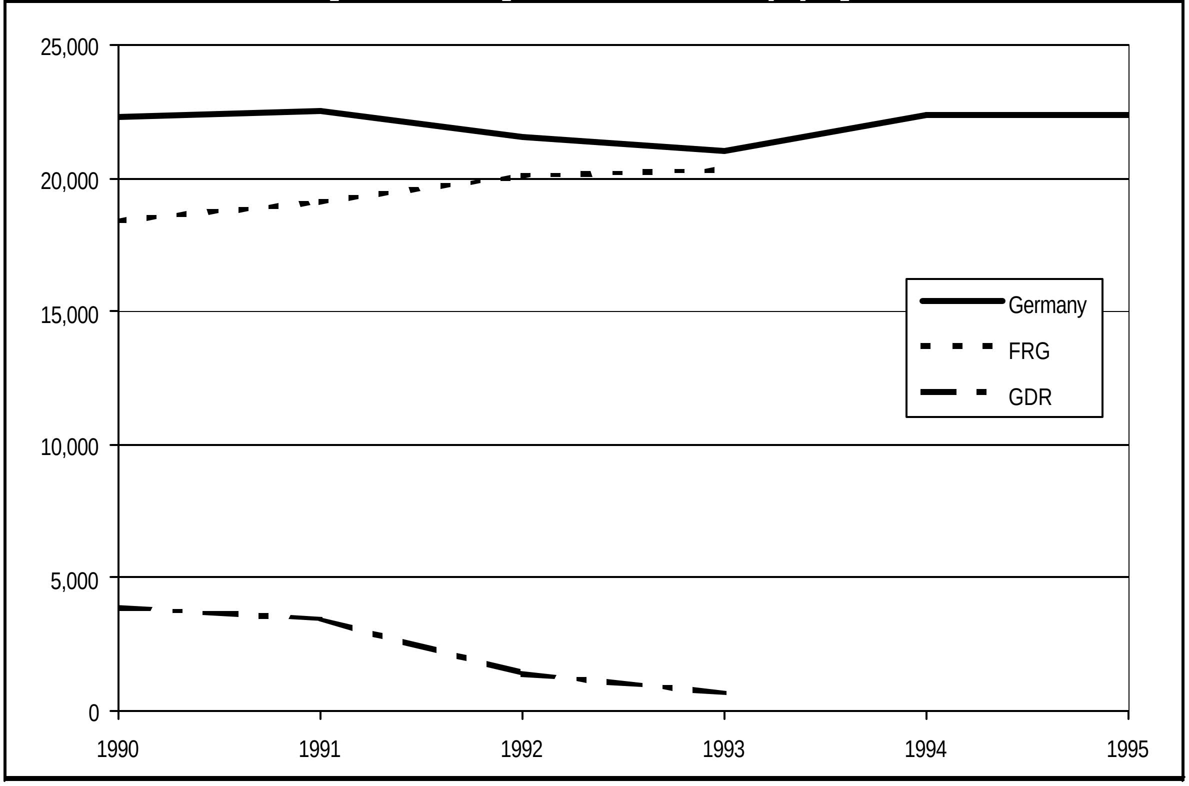
Figure 2. Ph.D. degrees awarded in the former FRG



SOURCES: Bundesministerium für Bildung, 1991-92 to 1996-97; and Statistische Bundesamt (1998).

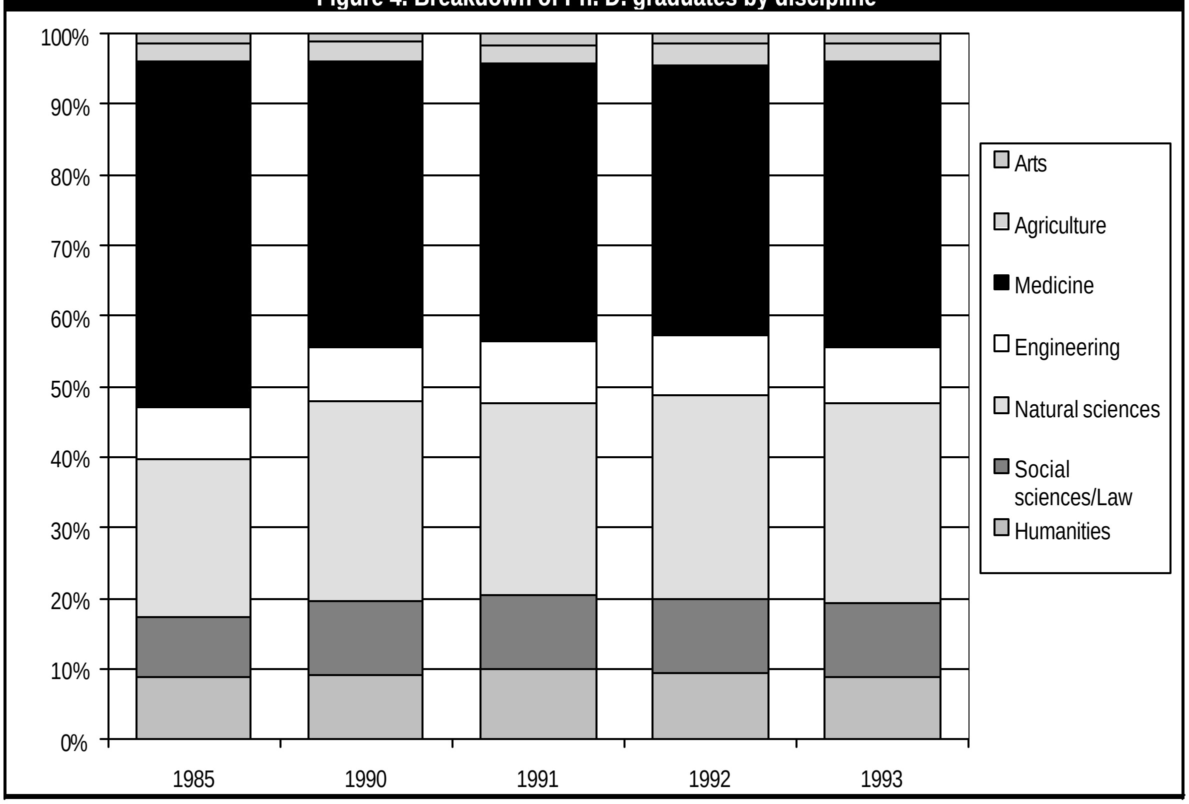
[2]This publication is a draft version of Enders (1996); the draft contains an analysis of the development of *Graduiertenkollegs* which was omitted in Enders (1996).

Figure 3. Ph. D. degrees awarded in Germany by region



SOURCES: Bundesministerium für Bildung, 1991-92 to 1996-97; and Statistische Bundesamt (1998).

Figure 4. Breakdown of Ph. D. graduates by discipline



SOURCES: Bundesministerium für Bildung, 1991-92 to 1996-97; and Statistische Bundesamt (1998).

Figure 5. Proportion of female Ph. D. graduates

SOURCES: Bundesministerium für Bildung, 1991-92 to 1996-97; and Statistische Bundesamt (1998).

sidered to be in need of reform. Long times to degree and low completion rates, as well as the fear of not keeping pace with European developments in higher learning, stimulated the German government to initiate experiments with new structures of doctoral education in 1986 (see Nerad 1994a and De Wied 1991). Illustrative is the following statement by the Wissenschaftsrat (1988): "the present state of Ph.D. training is too long, too specialized and too isolated…" Third, research policy objectives—such as the creation of more interdisciplinary work, the stimulation of joint and transparent research planning, and the advancement of applied research—were also cited as reasons to reform graduate schools.

The most striking reform in German doctoral education regards the introduction of the system of graduate schools in 1989, the so-called *Graduiertenkollegs*. The introduction of the *Graduiertenkollegs* has not replaced the previous situation, but it certainly marks the beginning of a shift in German doctoral education.

The establishment of a system of *Graduiertenkollegs* can be considered one of the few top-down operations in the area of doctoral education. The German federal government does not have extensive power over higher education: it influences higher education primarily through budgetary policies (Frackmann and De Weert 1994, p. 141). More responsibilities over education exist at the level of the 11 *Länder* that must comply with the Framework Act on Higher Education (HRG). But doctoral education in the German higher education system has remained a rather autonomous area, only lightly touched on in the margin of research policies and reforms of first degree education. The HRG authorizes universities and faculties to establish their own regulations in accordance with the law of the *Land*. The government of the *Land* should formally approve such regulations (Baldauf 1998, p. 171). Although the idea of the graduate school developed in close cooperation with representatives of the academic world, the program for the stimulation of graduate schools is strongly backed and shaped by (semi-) governmental organizations.

In 1986, the Wissenschaftsrat, which is the leading advisory board in scientific affairs, recommended the creation of graduate schools. The German federal government and the *Länder* governments accepted the recommendations of the Wissenschaftsrat. In December 1989, the federal government and the governments of the *Länder* signed an agreement on joint support for *Graduiertenkollegs*.

The implementation of the entire program was assigned to the Deutsche Forschungs Gemeinschaft (DFG). The DFG describes the *Graduiertenkollegs* as: "university institutions devoted to the promotion of young graduates. They are designed to enable Ph.D. students to work on their theses within the framework of a systematic and mostly interdisciplinary program of study and in cooperation with various research groups working on allied topics" (DFG 1993, pp. 1-2). The DFG has formulated the following objectives for the system of *Graduiertenkollegs*, which are supported by the Wissenschaftsrat (DFG 1996b, p. 1; and Wissenschaftsrat 1994, p. 15):[3]

1. To engage doctoral candidates in joint research activities of the participating institutions and thus move beyond the supervision of a single professor.

2. To strengthen supervision both qualitatively and organizationally through guest professors, research seminars, and the like.

3. To prevent overspecialization through a research-oriented study program.

4. To stimulate mobility and other forms of support for Ph.D. candidates that might foster educative opportunities.

5. To provide participating professors with the opportunity to cooperate with qualified young academics.

6. To open up possibilities for institutions to choose priority areas for research and research training.

7. To contribute to the restructuring of higher education in general.

The first reactions to the idea of the *Graduiertenkolleg* were ambiguous. Some institutions feared they would lose their traditional monopolies. The faculties of philosophy, for example, were reluctant to alter the *Doktorvater* system; and the West German Rektorenkonferenz expressed its concerns regarding the financial consequences of the *Graduiertenkollegs* for universities. Other organizations feared that the schools would create a new elite education at the expense of high-quality first degree studies (Müller 1993, p. 31). Nevertheless, in several fields, a strong interest was expressed in establishing *Graduiertenkollegs*; by 1988, 15 experimental *Graduiertenkollegs* were established, funded by the Thyssen and Volkswagen Foundations. In 1990, the Programm zur förderung von Graduiertenkollegs officially started.

A proposal to establish a *Graduiertenkolleg* is drawn up by the engaged scientists and submitted to the respective departments of education in the *Land* where the university is established. After approval, the application is forwarded to the DFG. At the DFG, several academic committees assess the proposals on a number of criteria. If the proposal is approved and selected, then the *Graduiertenkolleg* receives funds for a 3-year period. After 3 years, the school is evaluated and may receive funds for another 3 years. The idea is that no further grants are provided after 9 years—the perceived full life-cycle of a *Graduiertenkolleg*.

Between 1990 and 1993, 512 applications for the establishment of a *Graduiertenkolleg* were submitted to the DFG; of these, 199 were granted. Three years later, in May 1996, the number of approved and established *Graduiertenkollegs* increased to 214, and in 1997 reached 280 (see table 1). Eventually, the number of *Graduiertenkollegs* is expected to stabilize at around 300, a number that is not only determined by financial reasons but also based in the idea that excellence in research and research training can only be achieved through selectivity. The DFG has therefore declined proposals to expand the number of *Graduiertenkollegs* to 600 or 1,000. In these *Graduiertenkollegs*, 4,936 *Nachwuchswissenschaftler*[4] and 2,401 professors were engaged. The number of doctoral candidates residing in *Graduiertenkollegs* is 4,385; of these, 2,500 candidates were funded by the DFG. In 1996, the average number of doctoral candidates participating in a *Graduiertenkolleg* was 21.

Table 1. Number of *Graduiertenkollegs* by discipline

Discipline	1993	1994	1995	1996	1997
Total	175	199	203	214	280
Social sciences and humanities	57	64	63	64	81
Biology and medicine	37	44	45	51	72
Natural sciences	61	69	72	71	90
Technical sciences	20	22	23	28	37

SOURCE: Deutsche Forschungsgemeinschaft. *Entwicklung und Stand des Programms "Graduiertenkollegs" (Graduate schools).* Bonn: DFG (1997), p. 3.

[3] Translation by authors.

[4] *Nachwuchswissenschaftlern* are doctoral candidates as well as postdoctorates.

Patterns of Support

Funding for doctoral work is generally acquired in four ways: (1) in junior positions at universities, (2) in junior positions at research organizations outside universities, (3) through grants from various institutions, and (4) through self-support (Wissenschaftsrat 1995, pp. 23-36). These categories are detailed below.

- **Junior positions at universities.** Universities employ roughly 7 out of 10 doctoral candidates in junior positions (usually called *wissenschaftliche Mitarbeiter*). Often, the contracts are on a temporary basis, and doctoral candidates may complete several of these contracts during their doctoral work. Mainly because of the growth in contract research, the number of *wissenschaftliche Mitarbeiter* grew between 10 and 15 percent in the 1990s (Baldauf 1998, p. 169). Salaries vary from DM1800 to DM2000 for part-time contracts and from DM3000 to DM3200 for full-time contracts (after taxes and health insurance payments).

- **Junior positions at research organizations outside universities.** Research institutions outside the universities employ another 4,500 doctoral candidates, usually on 3-year contracts.

- **Various grants.** Doctoral work is also funded by grants. Around 8,500 stipends are provided by a number of organizations. The most important of these are mentioned here. The *Länder* grant around 2,500 stipends yearly (*Graduiertenförderung der Länder*). The DFG funds around 2,300 through its graduate school program (discussed earlier). A number of other institutions, such as political parties, churches, and trade unions (*Begabtenförderungswerke*), provide around 2,700 doctoral grants under strict conditions. The level of the scholarships varies, but the stipends provided by the DFG are DM1400 (DM1700 for technical subjects).

- **Self-support.** About 1 out of 10 doctoral candidates is believed to prepare a dissertation without any of the above-mentioned types of funding (Wissenschaftsrat 1995, p. 36).

Table 2 and figure 6 present the proportions and absolute numbers of doctoral candidates using the various sources of support.

Table 2. Sources of support in 1995 (estimated)

Source of support	Percent	Number
Total	100	63,000
Junior staff at universities	70	44,000
Junior staff at research institutes	7	4,500
Grants *lander*	4	2,500
Grants DFG	4	2,300
Grants *begabten*	4	2,700
Grants other	2	1,000
Self-financed	10	6,000

SOURCES: Wissenschaftsrat (1995), pp. 23-36 and Baldauf (1998), p.169.

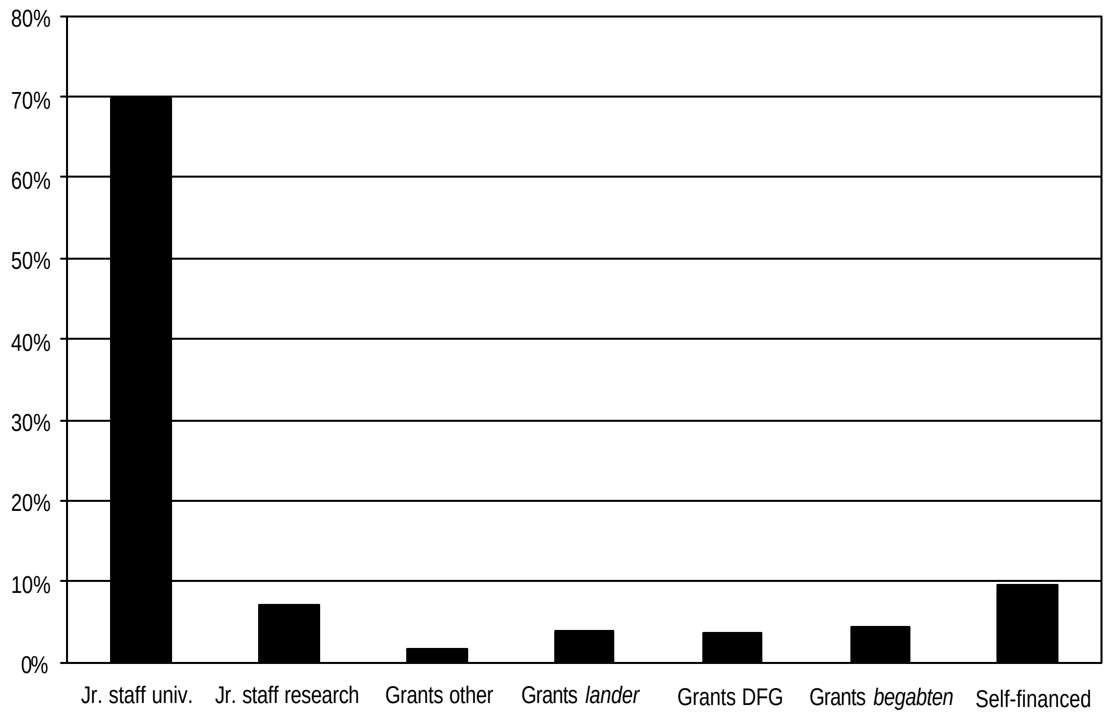
There are considerable differences in both the sources and levels of support for doctoral candidates. The majority of Ph.D. candidates in junior positions are involved in research, teaching, and contract work. They gain valuable professional experience throughout their doctoral work. A disadvantage of this situation, however, is the lengthening completion times that occur due to the dovetailing of doctoral studies and professional work (Baldauf 1998, p. 170). In this regard, work at research institutions outside universities provides a more favorable environment: around 70 percent of the candidates here complete a dissertation in 3 years. At these institutions, doctoral work is more closely supervised and thesis-related, and candidates are well funded for their work (Nerad 1994a).

Another area of concern is the difference between DFG stipends and alternative sources of support, which seems to discourage student participation in *Graduiertenkollegs*. This contrasts strongly with the goal that *Graduiertenkollegs* should attract the most talented candidates. In a study on the institutionalization of graduate schools in Germany, a respondent commented on this issue (Bartelse 1999, p. 147): "Of course, we would all like the best students to enroll in our programs. But in a number of disciplines, it is not a matter of strict selection. The grants of the DFG are relatively low, which makes it difficult to attract doctoral candidates."

Employment Patterns

Investigations into the labor market situation of doctoral degree-holders are few. Baldauf (1998) mentions that most studies are small scale or date back to the mid-1980s. There is a strong need for research into this area, and, as a matter of fact, the Wissenschaftlichees Zentrum für Berufs- und Hochschulforschung at the University of

Figure 6. Sources of support in percentages for 1995 (estimated)



SOURCES: Wissenschaftsrat (1995), pp. 23-36 and Baldauf (1998), p.169.

Kassel is conducting a research project on this issue. For quantitative information on employment patterns, we must await the outcomes of this study.

The material available on the labor market situation of Ph.D.s in Germany suggests a mixed picture. Depending on the discipline, the orientation of the individual doctorate-holder will be toward an academic research position, industrial research position, or job in policy and management. Outside academia, the doctorate seems to be esteemed. The number of doctoral degree-holders in top positions in German businesses is disproportionate, reflecting the high status of the doctorate in the German private sector. Several authors indicate that doctoral degree-holders will increasingly move out of the university sector. A study on junior staff working on their doctoral theses concludes that:

> Data show that the academic work and further qualifications of doctoral staff cannot be interpreted as the preparation for an academic career, but must also be interpreted as preparation for future employment outside higher education. The majority of doctoral staff do not intend to continue an academic career and…nearly all of these junior staff members in all fields expect that they will have to leave their university and the area of higher education (Enders and Teichler 1994, p. 31).

The issue of the labor market position of Ph.D.s is rather controversial (Baldauf 1998, p. 176). Even within the broad discussions of the *Graduiertenkollegs*, the subject is barely touched upon. The *Graduiertenkolleg* is meant to prevent doctoral candidates from conducting their work in isolation and specialization. But despite the introduction of more breadth, the labor market orientation of doctoral research in a *Graduiertenkolleg* remains focused on the university and research. As such, no challenge to the existing situation is imposed. There is no explicit broader labor market perspective required for the establishment of a school. A representative from the Wissenschaftsrat commented on this (Bartelse 1999, p. 148): "Currently, the issue of a broader employability perspective is slowly gaining ground in the discussions on doctoral education. However, I do not believe that it was on our minds at the outset of the system of *Graduiertenkollegs*."

Patterns of International Mobility

Doctoral education has always been international, and the area now known as Germany has been an important place for research training. In medieval times, students traveled all over Europe in search of knowledge and a good education. Throughout the course of history, these journeys sometimes abated due to political tensions or for protectionist reasons. But during the heyday of the German research universities, voyages for knowledge were commonplace. In reaction to these travels, doctoral programs were established on the other side of the Atlantic to keep young American scholars home.

In the post-war decades, international exchange often took place on the basis of personal contacts between individual professors. Recent visions of the European Union and of several European governments see these exchanges as insufficient (Blume 1993). The scope of European Community action in the field of education is defined in article 126(1) of the Maastricht Treaty (EU 1992): "The Community shall contribute to the development of quality education by encouraging cooperation between member states, while fully respecting the responsibility of the member states for the content of teaching and the organization of education systems and their cultural and linguistic diversity." Efforts to cooperate in the area of research training so far focus on mobility of researchers, particularly through the Training and Mobility of Researchers program, which is part of the European Commission's Framework Programmes. There have been suggestions to create a European doctorate[5] and to establish international, or rather, European centers for research training. As yet, however, these suggestions have not led to more extensive forms of cooperation in the area of doctoral training.

Another initiative to foster international exchange in the area of doctoral training involves a letter of interest signed between Belgium, Denmark, France, Germany, and the Netherlands in January 1996. These countries have committed themselves to support the exchange of doctoral candidates and inform each other on developments regarding doctoral programs and graduate schools.

The data available for Germany on international mobility in doctoral education and citizenship of doctoral candidates are scant. Figure 7 presents the absolute numbers of doctoral graduates with German citizenship, as compared to the number of doctoral graduates with foreign citizenship. Figure 8 reflects these data in percentages. A gradual increase of foreign doctoral degree recipients can be observed (from 5.5 percent in 1990 to 6.5 percent in 1993).

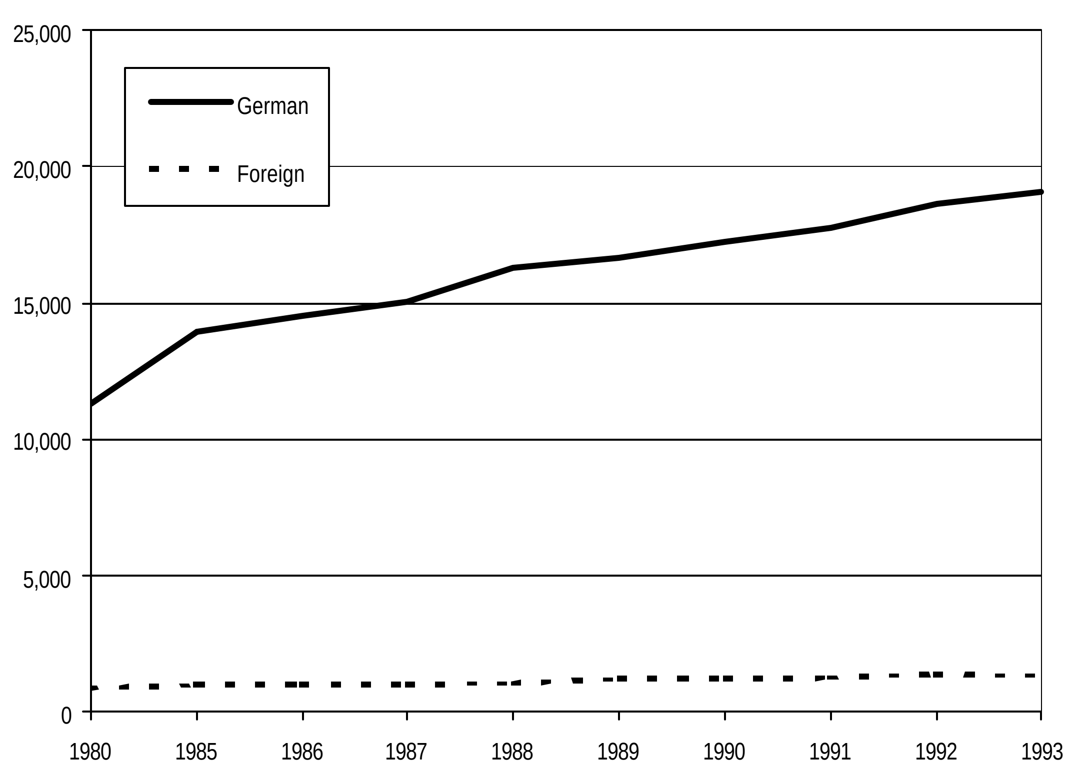
Through the *Graduiertenkollegs*, the internationalization of research and research training is supported by funding. The *Graduiertenkollegs* regard joint international projects and the exchange of doctoral candidates and research staff as important aspects of their function (DFG 1997). In 1995, 67 *Graduiertenkollegs* (33 percent) were involved in these international activities; by 1996, the number had risen to 81 *Graduiertenkollegs* (37 percent); and in 1997, to 133 *Graduiertenkollegs* (47.5 percent). The majority (53 percent) of these projects are with West European partners (53 percent); in 23 percent of the cases, cooperation is with U.S. or Canadian partners; 15 percent involve cooperation with Eastern Europe; and 9 percent with other countries.

---

[5] See EC (1995). The European doctorate will be accorded under the following conditions:

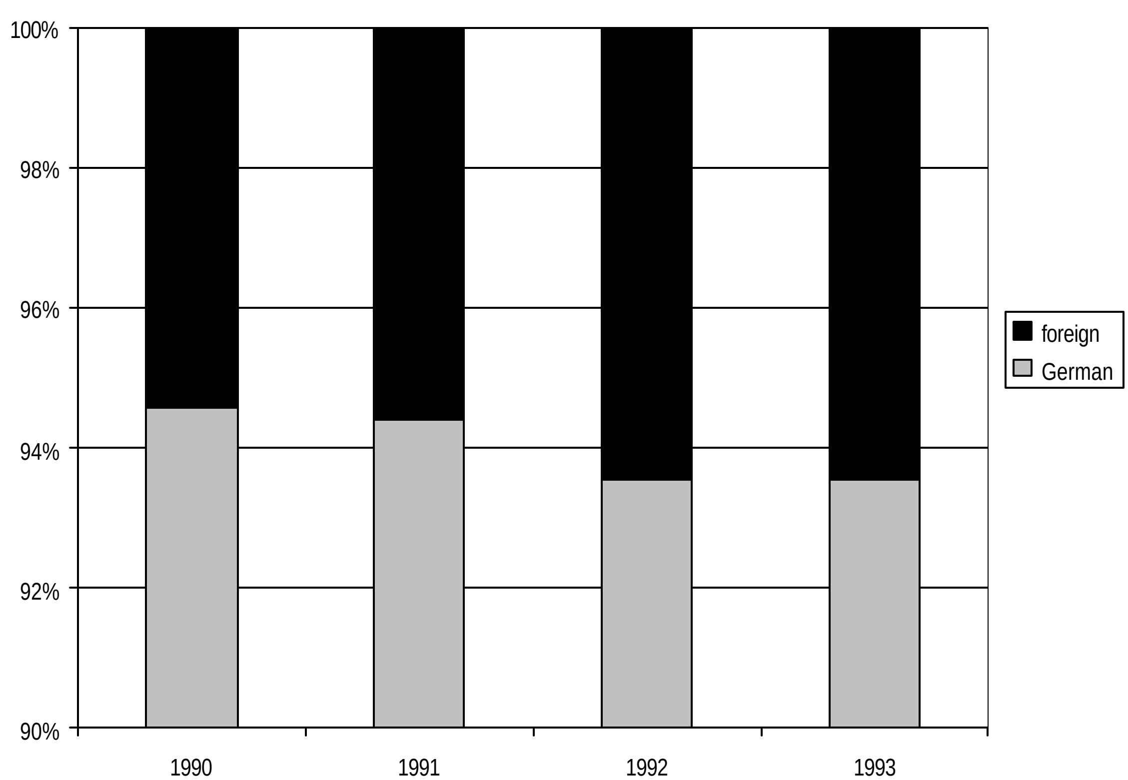
- If at least two professors from two higher education institutions of two European countries, other than the one where the Ph.D. thesis will be defended, have given their judgment.
- If at least one member of the jury comes from a higher education institution in European countries, other than the one where the Ph.D. thesis will be defended.
- If part of the defense takes place in one of the official languages, other than the one(s) of the country where the Ph.D. thesis will be defended.
- If the Ph.D. thesis has been prepared partly as a result of a period of research of at least one trimester spent in another European country.

Figure 7. Number of German and foreign citizen doctoral degree recipients



SOURCE: Bundesministerium für Bildung, 1991-92 to 1996-97.

Figure 8. Percentage of German and foreign citizen doctoral degree recipients



SOURCE: Bundesministerium für Bildung, 1991-92 to 1996-97.

Acknowledgments

The authors wish to thank Petra Boezerooy, Frans Kaiser, and Anne Klemperer from the Center for Higher Education Policy Studies Higher Education Monitor Unit for the statistical information provided.

References

Baldauf, B. 1998. Doctoral Education and Research Training: Towards a More Structured and Efficient Approach? *European Journal of Education* 33(2).

Bartelse, J.A. 1999. *Concentrating the Minds: The Institutionalization of the Graduate School Innovation in Dutch and German Higher Education.* Utrecht: Lemma.

Blume. 1993. Lecture at the Conference on Postgraduate Research Training.

Bundesministerium für Bildung, Wissenschaft, Forschung und Technologie (*Grund- und strukturdaten)*. 1991-92 to 1996-97.

Clark, B.R., ed. 1993. *The Research Foundations of Graduate Education: Germany, Britain, France, United States, Japan*. Berkeley: University of California Press.

———. 1995. *Places of Inquiry*. Berkeley: University of California Press.

De Weert, E., and E. Frackmann. 1994. Higher Education Policy in Germany. In L. Goedegebuure et al., *Higher Education Policy: An International Comparative Perspective.* Oxford: Pergamon Press.

De Wied, D. 1991. *Postgraduate Research Training Today: Emerging Structures for a Changing Europe.* The Hague: Netherlands Ministry of Education and Science.

Deutsche Forschungsgemeinschaft (DFG). 1993. *Bericht: drei Jahre Graduiertenkollegs.* Bonn.

———. 1995. *Graduiertenkollegs: Studienprogramme und Statistik 1995*. Bonn.

———. 1996a. *The Graduiertenkollegs and the CMPRT-Initiative: Aims and Programmes*. Bonn.

———. 1996b. *Merkblatt*. Bonn.

———. 1997. *Entwicklung und Stand des Programms "Graduiertenkollegs."* Bonn.

Enders, J. 1995. *Die Wissenschaftlichen Mitarbeiter: Ausbildung, Beschäftigung und Karriere der Nachwuchswissenschaftler und Mittelbauangehörigen an den Universitäten*. Draft. Frankfurt: Campus Verlag.

———. 1996. *Die Wissenschaftlichen Mitarbeiter: Ausbildung, Beschäftigung und Karriere der Nachwuchswissenschaftler und Mittelbauangehörigen an den Universitäten*. Frankfurt: Campus Verlag.

Enders, J., and U. Teichler. 1994. Doctoral Staff in German Higher Education: Selected Findings From the German Survey on the Academic Profession. *Higher Education Policy* 7(1).

European Commission (EC). 1995. *Memorandum on European Cooperation With Regard to Postgraduate Studies*. Brussels.

European Union (EU). 1992. *The Treaty on European Union (Maatricht Treaty)*. Brussels.

Frackmann, E., and E. De Weert. 1994. Higher Education Policy in Germany. In L. Goedegebuure et al., eds., *Higher Education Policy: An International Comparative Perspective.* Oxford: Pergamon Press.

Frijdal, A., and J.A. Bartelse. 1999. *The Future of Postgraduate Education*. Brussels: Commission of the European Union. In press.

Frijdal, A. Postgraduate Training in Europe: Genesis and Critical Questions. In C.M. Bolle, *Higher Education: Mass Enrolment and Quality*, pp. 45-56. Groningen: GCCE University of Groningen.

Gellert, C. 1993. The German Model of Research and Advanced Education. In B.R. Clark, ed., *The Research Foundations of Graduate Education: Germany, Britain, France, United States, Japan*. Berkeley: University of California Press.

Huber, L. 1986. A Field of Uncertainty: Postgraduate Studies in the Federal Republic of Germany. *European Journal of Education* 21(3): 287-305.

Kaiser, F., J. Hezemans, and H. Vossensteyn. 1994. *Doctorate Education: A Comparative Description of the Systems Preparing for the Highest Academic Degree (Doctorate) in Seven Western Countries.* Enschede: Center for Higher Education Policy Studies.

Kouptsov, O., ed. 1994. *The Doctorate in the European Region*. Bucharest: CEPES.

Morrell, J.B. 1990. Science in the Universities: Some Reconsiderations. In T. Fränsmyr, ed., *Solomon's House Revisited: The Organization and Institutionalization of Science*. Canton: Watson Publishing International.

Nerad, M. 1994a. *Postgraduale Qualifizierung und Studienstrukturreform: Untersuchung ausgewahlter Graduiertenkollegs in Hessen im vergleich mit dem Promotiionsstudium in den USA.* Kassel: GhK.

———. 1994b. Preparing for the Next Generations of Professionals and Scholars: Doctoral Reform in Germany—The "Graduiertenkollegen." Paper presented at the ASHE International Seminar, Tucson, AZ.

Paulsen, F. 1906. *The German Universities and University Studies*. London: Longmans, Green.

Statistisches Bundesamt. 1998. Web site: <<http://www.statistik.bund.de/>>.

Wissenschaftsrat. 1988. *Empfehlungen zur Förderung von graduiertenkollegs.* Köln.

———. 1994. *Stellungnahme des Wissenschaftsrates zur Weiterfuhrung des Graduiertenkolleg-Programms*. Köln.

———. 1995. *Empfehlungen zur Neustrukturiering der Doktorandenausbildung und -förderung*. Saarbrucken.

NETHERLANDS

Jeroen Bartelse, Eric Beerkens, and Peter Maassen

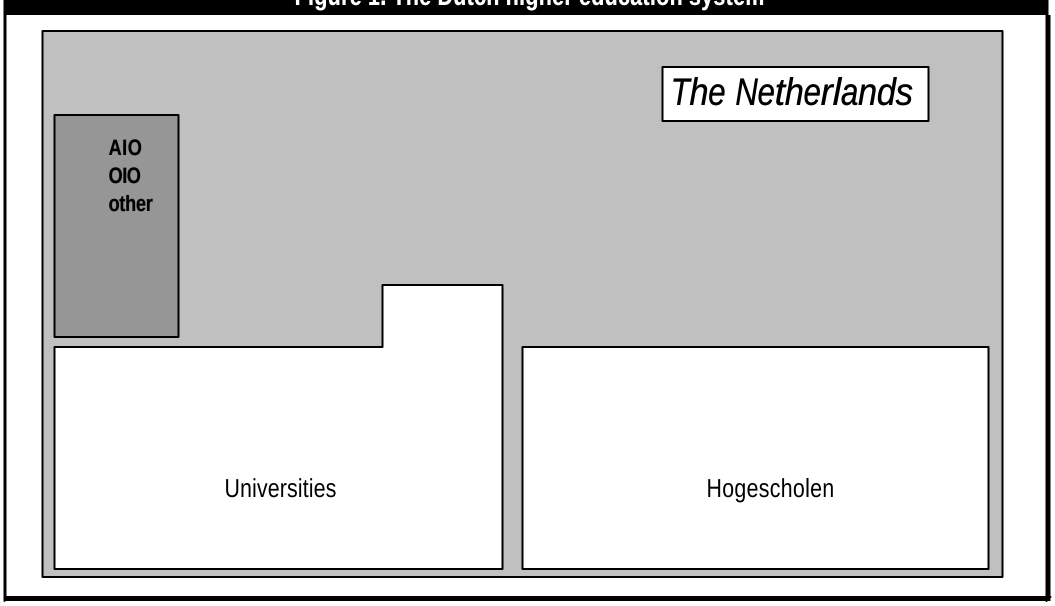
INTRODUCTION

The Netherlands has a binary system of higher education: a university sector and a nonuniversity sector primarily consisting of the *hogescholen*. In the *hogescholen*, advanced professional education is offered, comparable to that provided by the former British polytechnics. Around 80 *hogescholen* provide 4-year programs. Thirteen universities have been established that offer 4- to 5-year programs leading to the *doctorandus* degree. This degree roughly equates to the master's degree (Goedegebuure et al. 1994, p. 192). The *doctorandus* (which literally means "one who is entitled to become a doctor") degree is usually the minimal requirement for doctoral degree matriculation, although it is at the discretion of the universities to admit *hogeschool* graduates. Doctoral candidates may have a normal research or teaching position at universities or other research institutes, or they may hold a distinct doctoral position called the AiO or OiO.[1] At the initial postgraduate education level, both universities and *hogescholen* offer a variety of programs that lead to recognized degrees and generally have a market orientation. Figure 1 graphically presents the Dutch higher education system. In this report, we focus on the Dutch system of doctoral education.

TRENDS IN GRADUATE EDUCATION

In 1644, the University of Utrecht was the first to employ the title *Philosophiae Doctor et Liberalium Artium Magister* (literally, doctor of philosophy and master of a liberal art) (Hesseling 1986, p. 25). In those days, a dissertation could be either of two types of products, each with a distinct academic tradition of defense. The first type was the *disputatio sub praeside*, where the candidate defended a set of printed propositions—later a short essay—under the direction of the professor. The second type was the *dissertatio pro gradu doctoratus*, where the candidate had to defend a thesis against the opposition of a larger academic audience of students, doctors, and magisters. The public defense often featured an extensive ritual, such as the one at the University of Leiden, which involved an elaborate processional, speeches lauding the successful candidate, a recessional, and a graduation dinner. At present, many of these rituals are still featured at Dutch universities. In the 17th and 18th centuries, the doctorate represented a "vocational" degree rather than a research degree; the holder was entitled to teach.

Figure 1. The Dutch higher education system



SOURCE: D. De Wied, Postgraduate Research Training Today: Emerging Structures for a Changing Europe, The Hague: Netherlands Ministry of Education and Science, 1991.

[1] These positions are described later in this paper.

In the course of the 19th and early 20th centuries, the process of obtaining the doctorate gradually changed. Although Dutch universities remained institutions of education (Wachelder 1992, p. 28), the research ethos gained importance. The functions of the degree changed under the influence of the research imperative of the German universities and laboratories. The doctorate became proof of one's capabilities to conduct independent research. In the sciences in particular, renowned scholars formed research groups where research was conducted in master-apprentice relationships. Although inspired by German universities, the Dutch doctoral system has developed within its own distinct societal and academic context, and is sometimes not comparable to the German example.[2]

After World War II and up until the 1980s, an individual pursuing a Ph.D. was usually employed as faculty staff—sometimes in the position of a research assistant, but also as regular (senior) staff. Apart from being a profound rite of passage, the writing of a doctoral dissertation was an informal endeavor. The process was not a fixed series of tasks dictated by university or government standards. Usually, it had the characteristics of the apprentice model: a doctoral candidate working under the guidance of a professor. Yet, unlike the German situation, the role of the supervisor or chair-holder was less authoritative. The writing of the dissertation was primarily the responsibility of the person desiring the degree. There were, of course, strong differences by discipline.

In the natural sciences, research was conducted in laboratories through collaborative effort. As early as the 1950s, preparation of a dissertation in the sciences had shifted from individual work to an educational process supervised by senior staff and a supervisor. This, together with a clear demand for qualified researchers from outside the university, led to the concentration of larger groups of doctoral candidates in university laboratories (Beenakker 1990, pp. 321-22). A representative from this field once described this situation as follows (Bartelse 1999, p. 91):

> In the natural sciences there has always been a high degree of organization. The research team conducted a control function for the quality and proceedings of those working on a dissertation. The role of the professor can be compared as a coach: he gives intense guidance to the doctoral candidates without actually conducting the specialized research himself.

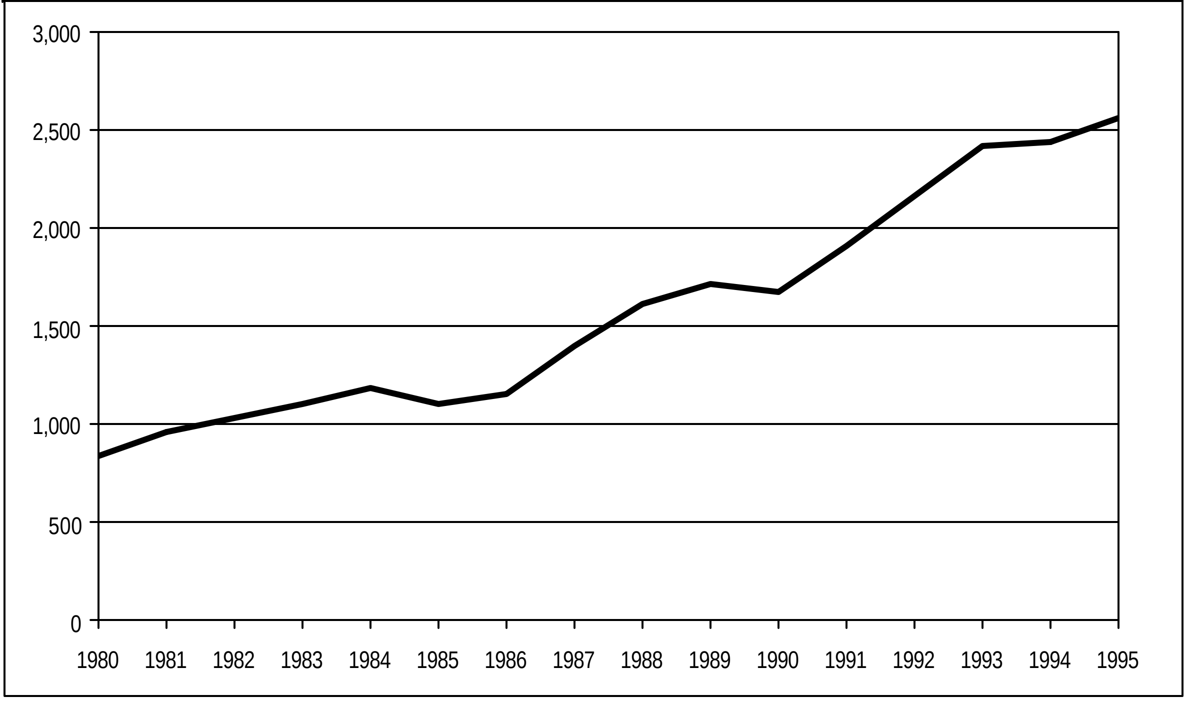
In contrast to the natural sciences, the role of the dissertation featured less prominently in the social sciences and humanities. The disjointed organization of research in the humanities and social sciences stimulated individual undertakings. The dissertation was written in relative isolation, in addition to fulfilling teaching and research responsibilities. Caught between the demands of regular teaching and research loads and high ambitions, the thesis frequently became for these researchers a lifelong *magnum opus*. In addition, and unlike the natural sciences, a clear labor market demand for doctors in the social sciences never developed. Hence, these fields did not experience a structuring influence on the doctoral process from the outside. The role of the supervisor was also different than in the sciences. The candidate's supervisor was actually more of a colleague who, once in a while, commented on the work in progress.

Since the 1960s, the Dutch government has moved into the area of research training. In a series of policy statements and laws, attempts have been made to adjust or reform doctoral training according to varying objectives. These are addressed in the next section. In the remainder of this section, we provide some quantitative trends on doctoral education.

As said, doctoral work can be conducted while serving in one of two junior positions that were created for doctoral candidates in 1986. Thus, a candidate can be an assistant in education (*assistent in opleiding*—AiO) if employed by a university, or a researcher in education (OiO) if employed by the Netherlands Organization for Scientific Research (NWO). Dissertations are also prepared while employed in normal research positions at universities or in a candidate's spare time. About this latter group of doctoral candidates, the available information is less detailed and less accurate. Figure 2 presents the number of Ph.D. degrees awarded between 1980 and 1995. The number of Ph.D. graduates has risen from 700 in 1980 to 2,600 in 1996. Since 1990—4 years after the introduction of the AiO system—the increase in awarded Ph.D.s is striking. Figure 3 shows a proportional breakdown of Ph.D. degrees by discipline.

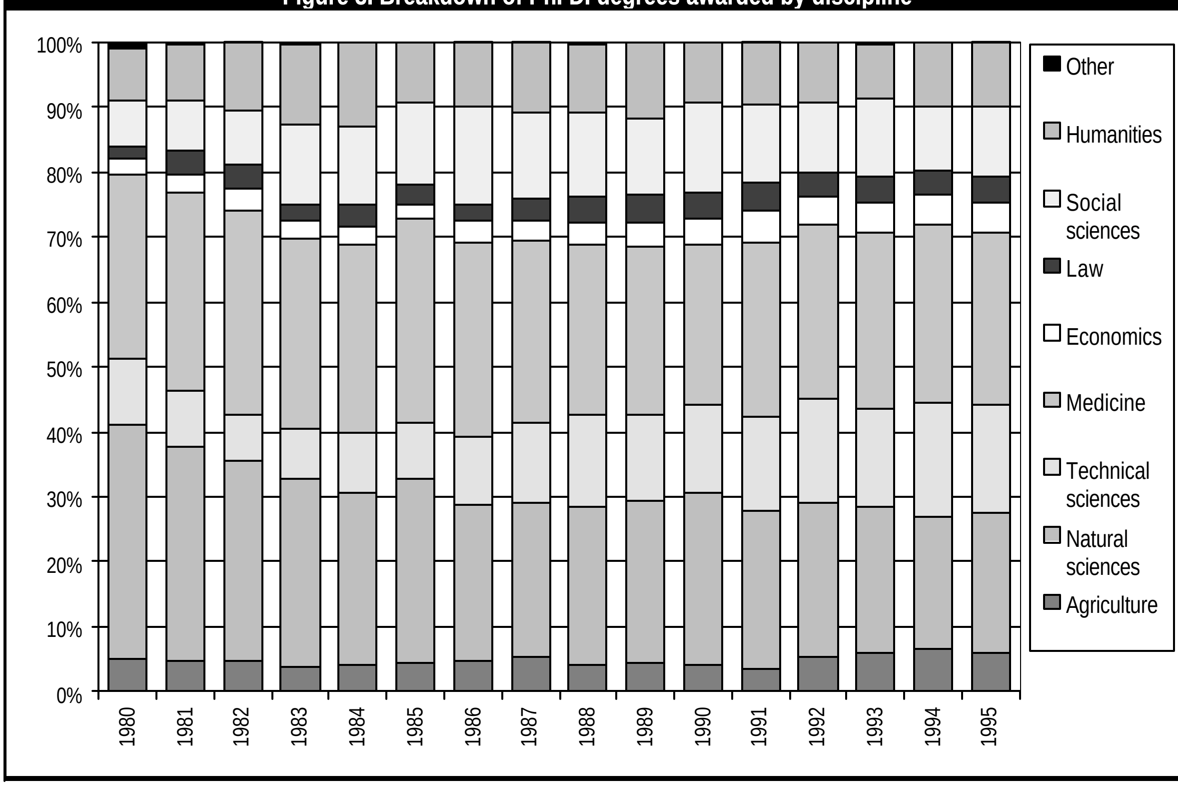
[2]Moreover, the German example did not provide an ambiguous model upon which to base a uniform research practice. For an elaboration of this point, see Wachelder (1992), pp. 27-22, and Clark (1995).

Figure 2. Number of Ph. D. degrees awarded, 1980-95



SOURCE: Vereniging van Samenwerkende Nederlandse Universiteiten (VSNU), *Kengetallen Universitair Onderzoek 1996/1997.* Utrecht.

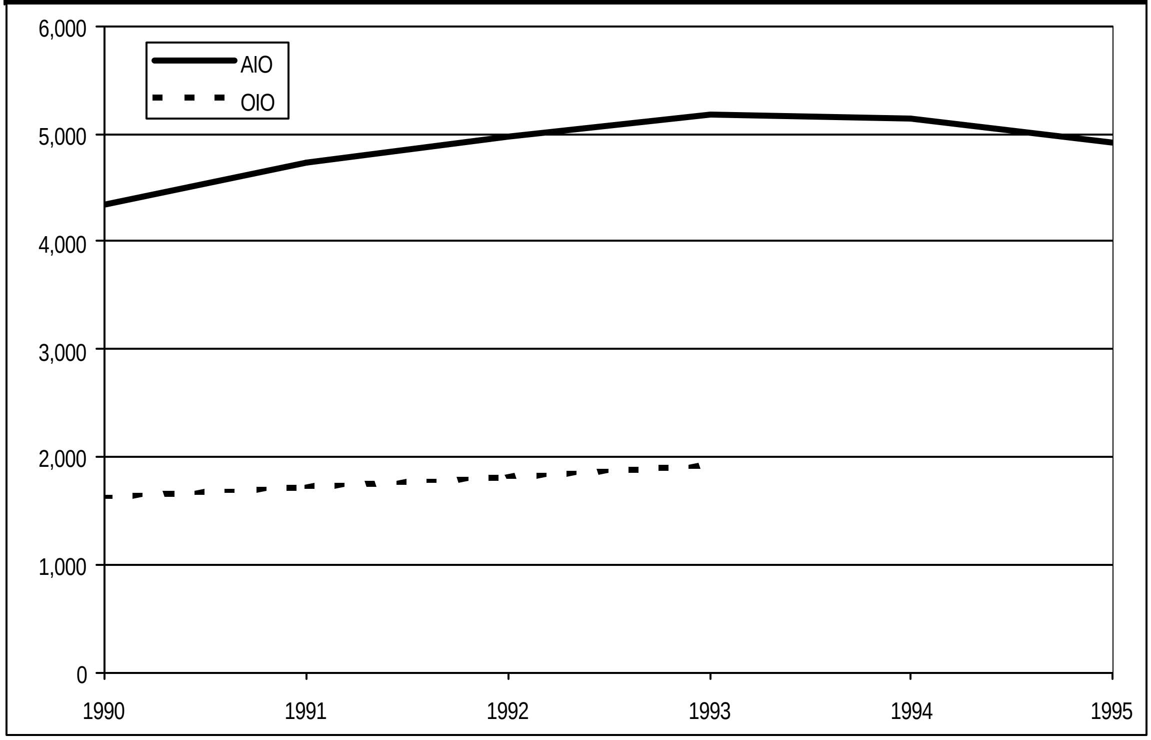
Figure 3. Breakdown of Ph. D. degrees awarded by discipline



SOURCE: Vereniging van Samenwerkende Nederlandse Universiteiten (VSNU), *Kengetallen Universitair Onderzoek 1996/1997.* Utrecht.

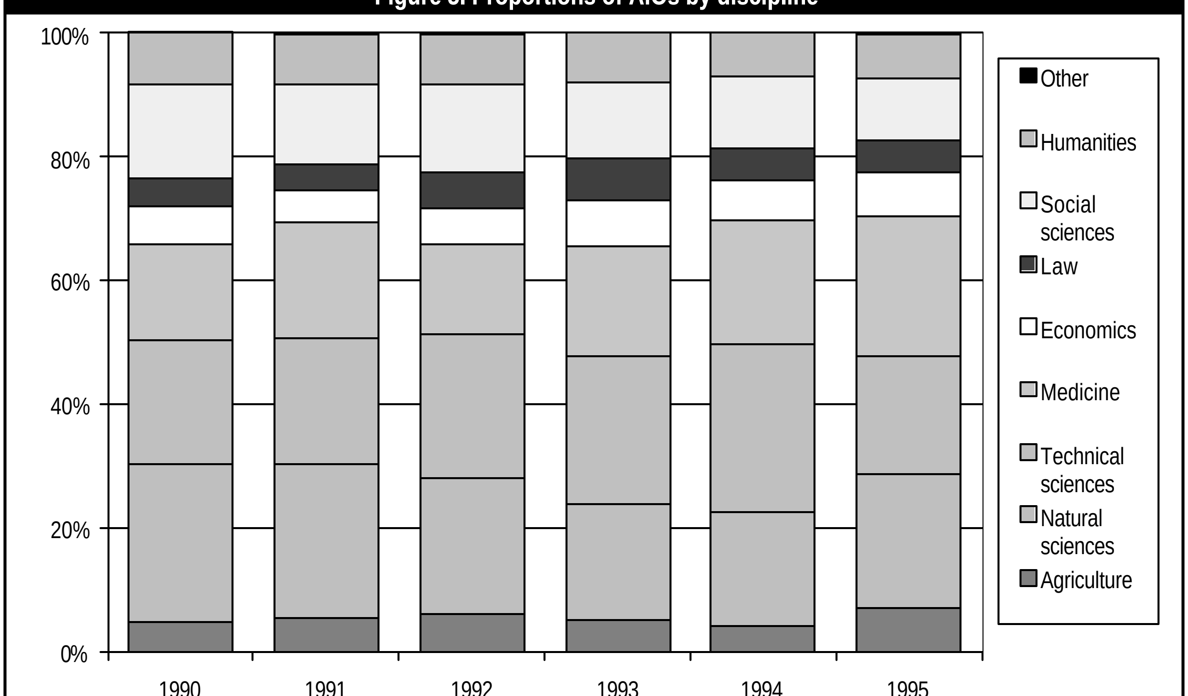
Figure 4 presents the number of doctoral students by type (AiO and OiO). Figure 5 shows the proportion of AiOs in various disciplinary fields. Female participation in doctoral education is reflected in figure 6: the participation of women in AiO positions has gradually increased from 29 percent in 1990 to 35 percent in 1995.

Figure 4. Number of doctoral students by type



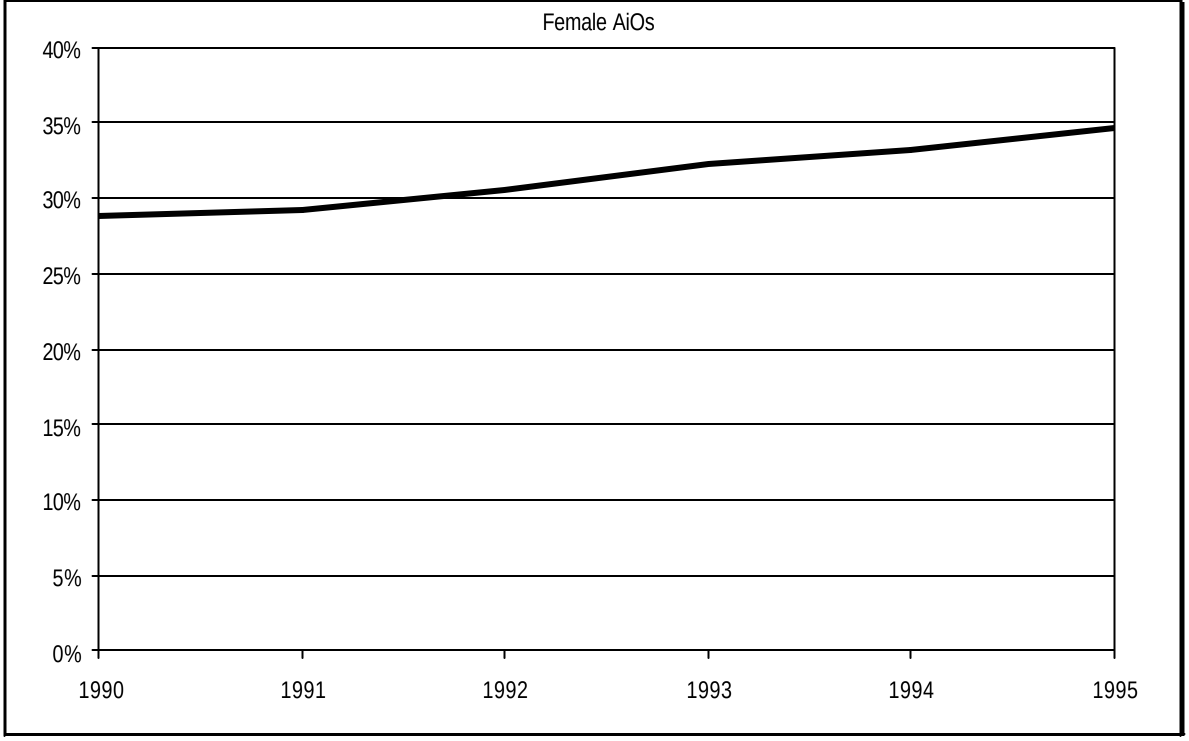
SOURCE: Vereniging van Samenwerkende Nederlandse Universiteiten (VSNU), *Kengetallen Universitair Onderzoek 1996/1997.* Utrecht.

Figure 5. Proportions of AiOs by discipline



SOURCE: Vereniging van Samenwerkende Nederlandse Universiteiten (VSNU), *Kengetallen Universitair Onderzoek 1996/1997.* Utrecht.

Figure 6. Female participation in doctoral education



SOURCE: Vereniging van Samenwerkende Nederlandse Universiteiten (VSNU), *Kengetallen Universitair Onderzoek 1996/1997.* Utrecht.

In the Netherlands, 7 percent of all Ph.D. candidates finish their degree within the nominal time of 4 years; after 5 years, this proportion is 35 percent; after 6 years, 55 percent. Eventually, 80 to 85 percent of Dutch candidates obtain a doctoral degree (VSNU 1996).

Doctoral Reforms

As mentioned in the previous section, government has moved into the business of doctoral education since the 1960s. It goes beyond the scope of this paper to describe the various policy developments that have occurred since then. We present here the main points of discussion that can be considered important impetuses to change in the doctoral system in the Netherlands.

The Function of Doctoral Training and the Doctorate

As university education massified and began to cater to a wide range of labor market positions, a discussion emerged to accommodate research training in a separate program. This implies a break with the traditional view, particularly in the social sciences and humanities, of the doctorate as a life-long masterwork. Instead, the doctorate becomes a proof of one's abilities to conduct independent research. Still, the criteria used to judge a doctorate (an original piece of research usually written as a monograph) stem from the early tradition and not from this new conception of doctoral training.

Structure and Duration of Training

Van Hout (1988) notes that two different models of doctoral training underlie the Dutch policy discussions. The first involves a 3- to 4-year period of work on a dissertation as a temporary staff member at a university. The second model consists of two stages, a 1-year student assistantship and a 2- to 3-year temporary assignment to write a dissertation. These models reflect disparate opinions as to what the time to degree should be. Until the introduction of the AiO system (see below), time to degree did not drop considerably, although the sciences were better able to restrict time to degree than the social sciences and humanities.

The Employed Educational Concept

Two educational models can be distinguished in the history of Dutch doctoral education. The idea of learning by doing (the apprenticeship model) prevails in early policy documents and laws. The professional model features more explicitly in the policy documents of the 1980s. The incorporation of coursework elements is motivated by the desire to shorten time to degree, to bring down attrition, and to be attuned to international developments.

Accessibility of Graduate Education and Selection of Candidates

As research training became a separate tier in university education, the issue of selection came to the fore. Usually, selection was considered to be based on individual competencies—although more random approaches have been proposed in the interest of greater egalitarianism (Sonneveld 1996, p. 34). The appropriate amount of first tier students to enter second tier education (more or less), and the selection procedures employed (open competition with equal chances or institutionally based competition less subject to objective criteria), were subject to discussion during almost all policy phases.

We here discuss two important, relatively recent, reforms in the Dutch doctoral system. The first regards the introduction of the AiO system in 1986; the second, the introduction of a system of graduate schools in 1991.

AiO System. Up until 1984, policy discussions on research training were almost a side effect of discussions on the organization of university education in general, rather than arising from perceived problems or systemic analysis of doctoral education. In 1984, a policy paper on doctoral education (Parliamentary Proceedings 1983-84, pp. 9-13) stated that the implementation of the second tier in general faced a number of problems. Concerns were expressed about the implementation of the so-called second tier as if it were a continuation of the first tier (i.e., first degree) education; about the lack of coherence in second tier program offerings; about inappropriate accessibility and selection mechanisms; and about the high expenditures in the second tier. With regard to research training specifically, the document expressed doubts about the value of the 1-year *onderzoekersopleiding* (the researcher-student) to the labor market. The policy paper suggested providing advanced research training by way of active participation of the candidates in university research and, to a limited extent (less than 25 percent), in teaching and administration. The idea was expressed of creating a separate employment position for the doctoral candidate. This position would comprise a 4-year appointment as a research trainee; this was the genesis of the above-mentioned AiO and OiO positions.

In the act that followed the policy, the AiO was introduced as a distinct academic position.[3] Regulations proscribing the position were published a year later. In summary, these comprised the following (Staatsblad 1986; see also Van Hout 1988, p. 15):

- The AiO has a temporary appointment in order to receive advanced scientific education.
- The objectives of the appointment are determined explicitly.
- The AiO usually holds his or her position for 4 years.
- The AiO conducts scientific research and records the results in a dissertation; the extent of this work, including instruction and supervision time, consumes at least 75 percent of his/her appointment.
- An instruction and supervision plan is drawn up for the AiO, and this plan is evaluated and adjusted after a year. In this plan is specified (1) what knowledge and skills are to be acquired and how, (2) who supervises the AiO, and (3) the number of hours the AiO is entitled to receive in personal supervision.
- After a year, an evaluation is conducted on the basis of the instruction and supervision plan. The university boards determine the evaluation procedures and criteria to be employed.
- At the end of the contract time, the AiO receives a certificate that reflects an overview of his/her publications, the education received, and his/her contributions to teaching.
- For the part of the appointment for which the AiO receives instruction and supervision (and thus does not conduct "productive labor"), he/she does not receive salary. This is specified for all AiOs in fixed percentages.

[3] AiOs are employed by the universities. The Dutch Research Council [not the same term used earlier in text] also employs doctoral candidates, under slightly different employment conditions; these are called researchers in training [not the same term used earlier in text] (OiO).

Although it is still possible to write a dissertation outside the AiO system, the regulatory framework uniformly structures the position of the doctoral candidate for all disciplinary fields. Of note is the status of the instruction and supervision plan: instruction—in addition to "learning by doing"—now occupies an important, formal place in the process leading to the doctorate.

Graduate Schools. The AiO system as such did not provide adequate mechanisms to shape the second tier of higher education satisfactorily. In March 1990, the Dutch minister of Education and Sciences established the Committee Rinnooy Kan (named after its chairman). This committee was tasked with investigating the creation of research schools. On the committee's establishment, the minister formulated five reasons for the development of research schools (Parliamentary Proceedings, 1990-91, p. 5; AWT 1994).

- There is a need for more structured research training. The introduction of the two-tier structure resulted in an accessible first tier limited in duration to 4 years, and a selective second tier that is expected to provide high-quality research training. As the AiO is expected to complete a dissertation in 4 years' time, a structured and well-supervised training trajectory is necessary.

- The Dutch society and economy are developing into a knowledge-intensive system. As a consequence, there is a need, both in the private and public sectors, for highly educated people—not only for first-tier-trained individuals, but also for those who have received further (research) training.

- Although research has always been an internationally oriented activity, it is expected that the internationalization of research will continued to grow. Researchers will become more mobile, and excellent centers of research will attract these researchers across borders. This calls for a reinforcement of the Dutch infrastructure.

- In order to operate internationally, sparse and scattered research capacity must be concentrated and fragmentation avoided. It is necessary to generate critical mass through cooperation among universities and other research institutions.

- Current governmental arrangements do not guarantee selectivity, which is the prerequisite for ensuring quality of research, researchers, and research training. More emphasis on selectivity in the research system is needed.

As expressed in these five points, the reason to establish research schools not only lay in the desire to give shape to research training—although this can be seen as the original motive (Ritzen 1990, p. 315; and Hazeu 1991, p. 112). The research school was also seen as a vehicle for stimulating the emergence of research centers of excellence to operate on an international scale.

In its report, *Vorming in Vorsen* (1990), the Rinnooy Kan Committee recommends a heterogeneous system of research schools, which would allow the different disciplines to retain their specific characters. The committee sees the university as the primary institution responsible for the research school. The universities serve as gatekeepers for the multitude of initiatives that may emerge at the faculty and departmental levels. Nevertheless, the committee also expects that a large number of research schools will develop ("between 50-150"). These schools should compete for resources from science foundations, industry, and European funds. Although the committee rejects to a large extent the concept of uniformity, it does formulate characteristics "that should be typical of all research schools" (Rinnooy Kan Committee 1990, p. 6). According to these characteristics, a research school should:

1. train individuals to become independent researchers;

2. be a high-quality research center;

3. be an independent organizational unit with budget responsibilities;

4. be affiliated with at least one university, but usually with more (university) institutions;

5. be of adequate size, so as to benefit from economies of scale;

6. carefully select research proposals and research assistants;

7. guarantee supervision and outstanding educational quality;

8. formulate a policy on postdoctorate positions;

9. have a good nexus with the first tier; and

10. be accountable and conduct evaluations.

The report explicitly reflects the initial call to create a satisfying structure of research training, but it also foresees the development of *topinstituten* (centers of excellence) as a means of securing high-quality research in selected areas. This latter aspect is captured in a proposal (the Snellius Program) to select two to three excellent research schools each year. These schools would receive extra financial support for a period of 5 years.

From the governmental standpoint, research schools are defined as centers of high-quality research in which structured training is offered to young researchers (Parliamentary Proceedings 1990-91). The reasoning behind this is that good training of researchers can only be conducted in an environment of high-quality research. The system of research schools should give impetus to high-quality research and education. Therefore, the minister decided to stimulate the development of a broad, yet selective, system of research schools, from which—eventually—should develop a limited number of centers of excellence. The government standpoint agrees in its main points with the advice of the Rinnooy Kan Committee. The government envisages a diverse system of research schools that share a number of common characteristics. The characteristics suggested by the Rinnooy Kan Committee are endorsed, but complemented on a few points. The minister acknowledges the importance of sufficient critical mass; he adds, however, that this consideration should not prevail over functional coherence. Therefore, the scale criterion is complemented with the condition that the school should have a sufficiently homogeneous training and research program. Another aspect in which the government standpoint adds to the committee's criteria regards the need for researchers in the labor market. In this respect, the minister stresses the importance of postdoctoral positions in a research school. Furthermore, the government stipulates that research schools should have budget responsibility; to this end, sufficient funds are to be allocated from the hosting universities to the research schools.

The government subscribes to the idea that research schools should be developed bottom-up. In order to allow this, yet to ensure quality, the government proposes a two-step procedure for the establishment of recognized research schools. At the faculty level, initiatives are undertaken to establish a research school. The executive board of a university—or boards, if more than one university is involved—determines whether such an initiative complies with the aforementioned criteria and may give the research school a legal foundation as a research institute. Also, the university boards sign a contract as to the resources available for the school for a period of at least 5 years. The next step toward recognition lies outside the university context. The minister has delegated the task of formal recognition of research schools to the Royal Dutch Academy of Sciences (KNAW). For this task, an independent committee (organizationally linked to the KNAW) named *Erkenningscomissie Onderzoekscholen* (Commission for the Recognition of Research Schools—ECOS) has been assigned. ECOS has designed, on the basis of the 10 characteristics identified by the Rinnooy Kan Committee, a protocol designating a procedure with which research schools should comply in order to achieve formal recognition.

By March 1998, 119 research schools had been registered in virtually all disciplinary fields (VSNU 1998, p. 6). ECOS has recognized 107 of these schools (table 1). Although the system of research schools is envisaged to include all doctoral candidates, participation rates differ by field. There is also variation in the level of development of the schools across these fields. The total number of AiOs and OiOs participating in research schools is around 7,460 (as of March 1998).[4]

Patterns of Support

Dutch doctoral candidates are basically funded by three different sources, called first, second, and third money flows (Koelman, Vossensteyn, and Jongbloed 1998). The first flow is supplied by the Ministry of Education, Science, and Culture to the universities. The universities pay their academic staff and AiOs from these funds. The second flow of funds is allocated through the NWO. From these funds, the OiOs are paid. The third flow of funds is acquired through contracts with government, nonprofit organizations, private companies, charitable boards, and the European Community. In addition to these sources of support, doctorates can be financed by other employers or on their own.

[4]Ten research schools did not submit quantitative information on this matter.

Table 1. ECOS-recognized research schools in the Netherlands						
Discipline	1992	1993	1994	1995	1996	1997
Total	19	24	62	86	98	107
Agriculture	0	1	2	5	5	5
Economics	1	1	1	1	2	3
Health sciences	5	6	12	13	15	15
Humanities	1	1	6	11	14	14
Law	0	0	0	1	1	2
Natural sciences	7	8	21	25	27	28
Social sciences	1	2	10	15	17	18
Technical sciences	4	5	10	15	17	22

SOURCE: Vereniging van Samenwerkende Nederlandse Universiteiten (VSNU), *Kengetallen Universitair Onderzoek 1998.* Utrecht.

Table 2 gives an overview of the sources of funding for doctoral candidates by money flow type (that is, the proportions of doctoral students using different sources of support). Table 3 shows the sources of support by field of study. These data should be taken as indicative rather than precise. The figures are taken from a study by Hulshof, Verrijt, and Kruijthoff (1996, p. 66) and reflect the characteristics of a survey population of 2,652 respondents.

Table 2. Funding sources for doctoral candidates (percentages)					
Funding source	Total	AiO	OiO	Doctoral univ	Doctoral ext
1st flow	46	81	6	47	9
2nd flow	29	12	88	29	25
3rd flow	27	21	8	31	17
Research inst	11	4	7	14	8
Other empl	7	2	4	3	39
Private	10	2	1	8	41
Total respondents	2,652	862	455	1,086	248

SOURCE: Hulshof, Verrijt, and Kruijthoff (1996), p. 66.

AiOs and OiOs receive salaries according to a special salary scale. In the first years of their appointments, salaries are cut back to compensate for the training they receive. Table 4 shows the monthly incomes for each year of their appointments (as of January 1, 1998).

Table 4. Monthly incomes of AiOs and OiOs	
Year of appointment	Salary
1st year	DFL 2.184,--
2nd year	DFL 2.495,--
3rd year	DFL 3.053,--
4th year	DFL 3.899,--

SOURCE: Hulshof, Verrijt, and Kruijthoff (1996), p. 66.

Recently, the labor market situation forced universities to change their financial support of AiOs. In 1995, a number of Ph.D.s coming out of the AiO system could no longer be absorbed by the (academic) labor market. The universities were, however, obliged to make unemployment payments, which signified an important financial loss. Some universities decided to introduce Ph.D. grants instead of employment. This would discharge them of the responsibility of making unemployment payments. The results for doctoral candidates can be imagined: lower incomes, poorer benefits, and a feeling of being unappreciated for their work.

In the following years, however, the labor market situation for academics improved considerably. Almost all universities abandoned the grant system, which is now only in place for Ph.D. programs that aim to attract international candidates. Instead, as AiO positions became difficult to fill, universities have started to complement AiO salaries to a level comparable to that for other academic staff members. This phenomenon is particularly commonplace at the universities of technology.

Table 3. Funding sources by field (percentages)								
Funding source	Agriculture	Natural science	Tech. science	Medicine	Economics	Law	Social science	Humanities
Total respondents	108	868	327	447	137	85	401	278
1st flow	37	42	47	36	69	81	58	52
2nd flow	34	44	30	31	18	20	26	31
3rd flow	33	16	35	41	12	6	20	8
Research inst	15	8	9	15	7	6	8	5
Other empl	5	5	11	6	8	1	6	4
Private	3	2	4	9	13	8	14	21

SOURCE: Hulshof, Verrijt, and Kruijthoff (1996), p. 66.

The recent developments in conditions of support illustrate the ambiguity that exists around this issue. AiOs and OiOs basically occupy a hybrid position at Dutch universities. On the one hand, they are students who receive training and supervision. On the other hand, they are considered the engine of scientific work. The financial support structure that was introduced in the framework of the AiO system basically reflects this hybrid position. But external forces, such as the labor market and the internationalization of postgraduate training, are increasingly putting pressure on this situation.

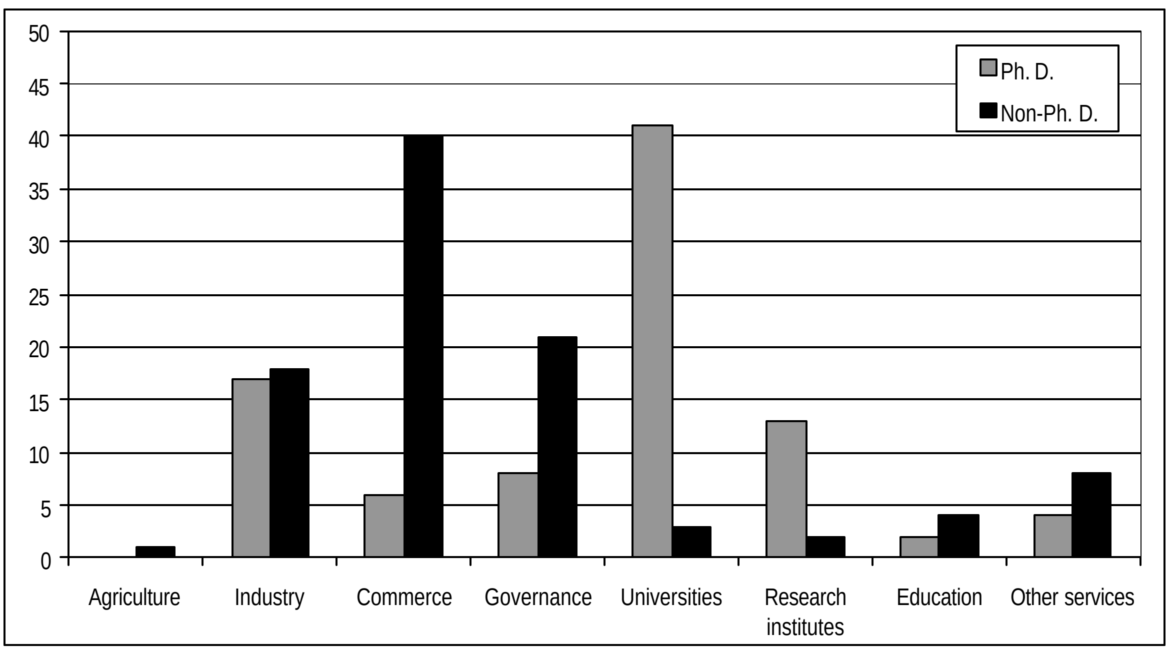
Employment Patterns

The labor market position of doctoral degree-holders has been the subject of discussion since the mid-1990s. The Dutch academic labor market was perceived as being unable to absorb the increasing number of young doctoral degree-holders aspiring to an academic career. At discussion seminars on this topic, doctoral candidates tended to refer to themselves as a "lost generation." In 1996, the Ministry of Education, Culture, and Science commissioned a study of the labor market situation for doctoral candidates (Hulshof, Verrijt, and Kruijthoff 1996).

Unemployment among doctorate-holders appeared to be less than among non-Ph.D.s: 6 percent versus 14 percent. For those Ph.D.s who obtained their degree through an AiO or OiO position, the unemployment figure is slightly higher: for AiOs, 9 percent; for OiOs, 12 percent (Hulshof, Verrijt, and Kruijthoff 1996, p. 51). This picture, as compared to the Dutch labor force overall, is not negative. However, employment conditions in terms of salaries and job security are generally less favorable for Ph.D.s.

Figure 7 shows the labor market destinations of Ph.D.s as compared to non-Ph.D.s. Clearly, most doctorate-holders find work in research and teaching positions at universities or research institutes (54 percent) or in industry (16 percent). There is, however, a move away from academia and into other positions. In 1983, 70 percent of Ph.D.s worked at universities; in 1995, only 38 percent were employed by a university. Although 70 percent of doctorate-holders have a research job—a figure that has been quite stable since 1983—most Ph.D.s exchange this type of work for another at some point along their career path.

Figure 7. Labor market destinations of Ph. D.s and non-Ph. D.s (percentages)



SOURCE: Hulshof, Verrijt, and Kruijthoff (1996), pp. 65-66.

Ongoing discussions of the labor market for Ph.D.s have gradually become less informed by pressing labor market issues, which allows for a more fundamental discussion of the labor market itself. There is a move toward discussing the consequences of a broader labor market orientation for doctoral education. If replenishment of the professorate is not the main labor market objective for the Ph.D. degree, then how should doctoral education (which is still very much focused on academic work after doctorate award) meet the societal needs of highly educated professionals? This issue fundamentally affects the orientation of doctoral education: toward the market or toward academia (see Bartelse and Hulshof 1996)? Subsequently, the question is being asked as to what implications this changing orientation will have for the process of acquiring a doctorate. If a broader labor market orientation is accepted, then the qualifications required for a Ph.D. graduate may need to be reconsidered. There are a few experiments with the "professional doctorate"—i.e., degrees for employed professionals—but the issue is still a sensitive one.

Patterns of International Mobility

Systematic data on the number of foreign doctoral students in the Netherlands and the number of foreign doctoral degrees earned by Dutch citizens are not available so far. Our impression is that Dutch universities increasingly attempt to attract foreign Ph.D. students. Particularly in the sciences, which face difficulties in filling vacant doctoral positions, the number of foreign doctoral students is increasing.

At the national and supra-national levels, several initiatives have been developed to stimulate international mobility of doctoral candidates (see also the German country report included in this volume). At the initiative of the Dutch Minister of Education and Science, Belgium, France, Germany, the Netherlands, and—later—Denmark established an international advisory committee on new organizational forms of graduate research training. The committee was established with the following terms of reference: to provide an opinion on the proposal of the Dutch Committee on Graduate Schools, particularly in light of European and international aspects; "to consider and compare the new organizational forms of graduate research training on a doctoral level currently emerging in many European countries…to provide indications and recommendations that allow for more cooperation at the level of graduate training; and to sketch ideas for the further evolution of these new systems of graduate training" (De Wied 1991, p. 9). The cooperation that evolved from this initiative has led to a letter of interest signed by Belgium, Denmark, France, Germany, and the Netherlands in January 1996. These countries have committed themselves to support the exchange of doctoral candidates and to inform each other of developments regarding doctoral programs and graduate schools.

The European Union is stimulating international cooperation in the area of doctoral training. In the post-war decades, international exchange often took place on the basis of personal contacts between individual professors. Recent visions of the European Union and of several European governments see these exchanges as insufficient (Blume 1993). The scope of European Community action in the field of education is defined in article 126(1) of the Maastricht Treaty (EU 1992): "The Community shall contribute to the development of quality education by encouraging cooperation between member states, while fully respecting the responsibility of the member states for the content of teaching and the organization of education systems and their cultural and linguistic diversity." Efforts to cooperate in the area of research training so far focus on mobility of researchers, particularly through the Training and Mobility of Researchers program, which is part of the European Commission's Framework Programmes. There have been suggestions to create a European doctorate[5] and to establish international, or rather, European centers for research training. As yet, however, these suggestions have not led to more extensive forms of cooperation in the area of doctoral training.

---

[5]See EC (1995). The European doctorate will be accorded under the following conditions:

- If at least two professors from two higher education institutions of two European countries, other than the one where the Ph.D. thesis will be defended, have given their judgment.
- If at least one member of the jury comes from a higher education institution in European countries, other than the one where the Ph.D. thesis will be defended.
- If part of the defense takes place in one of the official languages, other than the one(s) of the country where the Ph.D. thesis will be defended.
- If the Ph.D. thesis has been prepared partly as a result of a period of research of at least one trimester spent in another European country.

ACKNOWLEDGMENTS

The authors wish to thank Petra Boezerooy, Frans Kaiser, and Anne Klemperer from the Center for Higher Education Policy Studies Higher Education Monitor Unit for the statistical information provided.

References

Adviesraad voor Wetenschap en Technologie (AWT). 1994. *Advies over Onderzoekscholen*. Den Haag. No. 15.

Bartelse, J.A. 1999. *Concentrating the Minds: The Institutionalization of the Graduate School Innovation in Dutch and German Higher Education.* Utrecht: Lemma.

Bartelse, J.A. and M.J.F. Hulshof. 1996. Tien jaar AiO-stelsel: beelden van de arbeidsmarkt. *Tijdschrift voor Hoger Onderwijs Management* 5: 57-61.

Beenakker, J.J.M. 1990. Randvoorwaarden voor de Onderzoekersopleiding. *U&H* 36(6): 321-29.

Bijleveld, R.J., and J.V. Buissink. 1985. *De historie van de herstructurering van het wetenschappelijk onderwijs (1945-1981)*. Enschede: Center for Higher Education Policy Studies.

Blume. 1993. Lecture at the Conference on Postgraduate Research Training.

Clark, B.R. 1995. *Places of Inquiry*. Berkeley: University of California Press.

De Wied, D. 1991. *Postgraduate Research Training Today: Emerging Structures for a Changing Europe.* The Hague: Netherlands Ministry of Education and Science.

European Commission (EC). 1995. *Memorandum on European Cooperation With Regard to Postgraduate Studies*. Brussels.

European Union (EU). 1992. *The Treaty on European Union (Maatricht Treaty)*. Brussels.

Frijdal, A., and J.A. Bartelse. 1999. *The Future of Postgraduate Education*. Brussels: Commission of the European Union. In press.

Goedegebuure, L., et al., eds. 1994. *Higher Education Policy: An International Comparative Perspective*. Oxford: Pergamon Press.

Hazeu, C.A. 1991. Research Policy and the Shaping of Research Schools in the Netherlands. *Higher Education Management* 3(3): 283-91.

Hesseling, P. 1986. *Frontiers of Learning: The Ph.D. Octopus.* Dordrecht: Floris Publications.

Hulshof, M.J.F., and J.A. Bartelse. 1997. Tien jaar AiO-stelsel: feiten over de arbeidsmarkt. *Tijdschrift voor Hoger Onderwijs Management* 1: 60-65.

Hulshof, M.J.F., A.H.M. Verrijt, and A. Kruijthoff. 1996. *Promoveren en de Arbeidsmarkt: ervaringen van de 'lost generation'*. Den Haag: Ministerie van Onderwijs Cultuur en Wetenschappen.

Koelman, J.B.J., J.J. Vossensteyn, and B.W.A. Jongbloed. 1998. *University Funding Mechanisms in Europe*. Interim report on the first phase of the study. Enchede: CHEPS.

Parliamentary Proceedings. 1983-84. *Beleidsnota Beiaard*. Vergaderjaar, 18 320, nr.1.

———. 1990-91. *Onderzoekschool.* Vergaderjaar, 21 839, nr. 2.

Posthumus, K. 1968. *De Universiteit: doelstellingen, functies, structuren*. 's Gravenhagen: Staatsuitgeverij.

———. 1970. *Universitair Onderwijs: Structuren*. 's Gravenhagen: Staatsuitgeverij.

Rinnooy Kan Committee. 1990. *Vorming in Vorsen: van student tot zelfstandig onderzoeker.* 's Gravenhage.

Ritzen, J.M.M. 1990. Onderzoekbeleid toegespitst op de opleiding van onderzoekers. *U&H* 36(6): 314-20.

Sonneveld, H. 1996. *Promotoren, Promovendi en de Academische Selectie: de collectivisering van het nederlandse promotiestelsel, 1984-1995*. Amsterdam: Universiteit van Amsterdam.

Staatsblad. 1986. *Rechtspositieregeling Assistenten in Opleiding*. Jaargang, 430.

Van Hout, J.F.M.J. 1988. *Onderzoekers in opleiding*. Nijmegen: Instituut voor onderwijskundige dienstverlening.

Vereniging van Samenwerkende Nederlandse Universiteiten (VSNU). 1996a. *BIOS 1995*. Utrecht.

———. 1996b. *Kengetallen Universitair Onderzoek 1996/1997*. Utrecht.

———. 1997. *Kengetallen Universitair Onderzoek 1997*. Utrecht.

———. 1998a. *BIOS 1997*. Utrecht.

———. 1998b. *Kengetallen Universitair Onderzoek 1998*. Utrecht.

Wachelder, J.C.M. 1992. *Universiteit tussen Vorming en Opleiding: de modernisering van de Nederlandse universiteiten in de negentiende eeuw.* Hilversum: Verloren.

SWEDEN

Jeroen Bartelse, Eric Beerkens, and Peter Maassen

INTRODUCTION

The Swedish higher education system before 1977 can be characterized as heterogeneous and centralized. After the Second World War, a large variety of schools, colleges, and courses existed. Labor market and economic forces stimulated the government to introduce an ambitious policy and administrative measures that would expand the whole education system above grade 7. These measures led to an expansion of higher education that was probably faster than in any other Organisation for Economic Co-operation and Development country (Svanfeldt 1994). This expansion occurred mainly in the 1960s: at the end of this decade, there were about three times as many students in higher education as at the start of the decade. The capacity of the existing institutions was not sufficient to accommodate the student explosion. This resulted in the establishment of a parliamentary committee in 1968. The report by this committee, published in 1973, led to thorough reforms of the entire Swedish higher education system in 1977. Under these reforms, all higher education institutions became integrated into one system of tertiary-level education called the *högskola*. This is the Swedish collective name for higher education, encompassing not only traditional university studies but also those at the various professional institutes and university colleges, as well as a number of programs previously taught in other forms of the educational system. Most of the programs included in the broadened definition of higher education are under the jurisdiction of the Ministry of Education and Science, others are under the Ministry of Agriculture, and paramedical programs are under the county councils.

Between 1977 and 1993, a system of national programs existed in the Swedish higher education sector. The state determined the curricula, program length, overall aims, etc., of all higher education programs offered. The educational system was organized into general study programs, local study programs, and single subject courses. In 1993, the government decided to loosen requirements in order to allow for more variation at the local level, and thus more correspondence with the labor market. Under these reforms, institutions were allowed to develop their own programs.

With the 1993 reform of higher education, institutions were given increased autonomy in the organization of their studies, admissions, use of resources, and general organization. Under the present system, the government only specifies program lengths of degrees. Different degrees correspond to the number of "study points" needed to complete them. In figure 1, a graphical overview is presented of the Swedish higher education system. Three types of undergraduate degrees are offered. After 2 years, students earn 80 points and are eligible to receive a diploma (*Högskole*). Completion of a three-year program (120 points) is rewarded with a bachelor's degree (*Kandidat*), and students who complete 4 years (160 points) receive a master's degree (*Magister*). The Swedish system also offers two types of postgraduate degrees: the licentiate and the doctorate.[1] These are addressed in detail below. The total number of higher education students in 1996-97 was 300,380, of whom 16,550 were active postgraduate students. In this academic year, 840 licentiate degrees and 1,720 Ph.D.s were awarded (Högskoleverket 1998a). Professional degrees are also offered. The program lengths for these professional degrees vary from 1 to 5.5 years.

TRENDS IN GRADUATE EDUCATION

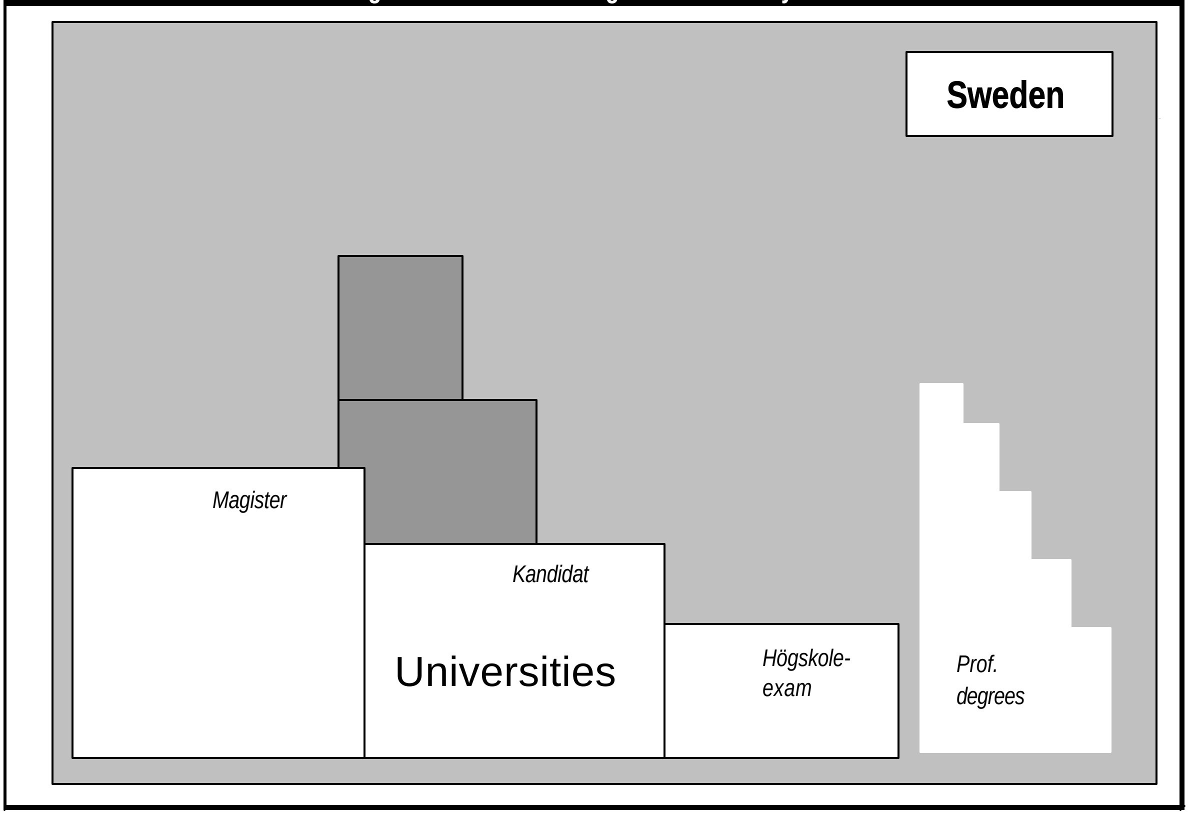
Until 1969, Sweden had a *Licentiatexamen* and a traditional doctorate. The median time of study from the *kandidatexamen* or *magisterexamen* to the licentiate was about 5 to 6 years, and the time from the licentiate to the doctorate was about 5 years. This means that, after completion of the undergraduate degree, the time to completion of the doctoral program was 10 years or more.

During the research training reforms of 1969, these degrees were replaced by the *doktorsexamen* with a time restriction and compulsory courses. The new postgraduate education system that was launched in 1969 had two main purposes (Zetterblom 1993):

- to shorten the time spent in graduate studies by introducing courses instead of literature studies, improving supervision of thesis work, and reduc-

[1]Throughout this report, we use the term "postgraduate" to refer to students in either licentiate or doctorate programs.

Figure 1. The Swedish higher education system



SOURCE: Statistica Centralbyrån (1997). *Universitet och hogskolor Forskarutbildning: Nyantagna, registrerade och examinerade lasaret 1993/94, 1995/96, and 1996/97. Örebro.*

ing demands on the thesis so that completion of the dissertation was seen as a career step instead of a life-long project; and

- to bring graduate education in Sweden closer to what was considered an international norm: the Anglo-Saxon Ph.D.

Since the 1969 reforms, the formal length of the program from enrollment to completion of dissertation has been 4 years. The average length of study, however, is still higher. For those who took the *doktorsexamen* in 1994, the program took an average of 7 years from admission to research training to thesis defense (Kyvik and Tvede 1998).

Across different faculties, however, there are large differences between lengths of study. The average duration of study in the humanities and social sciences, for instance, is considerably longer than in engineering, the natural sciences, and medicine.

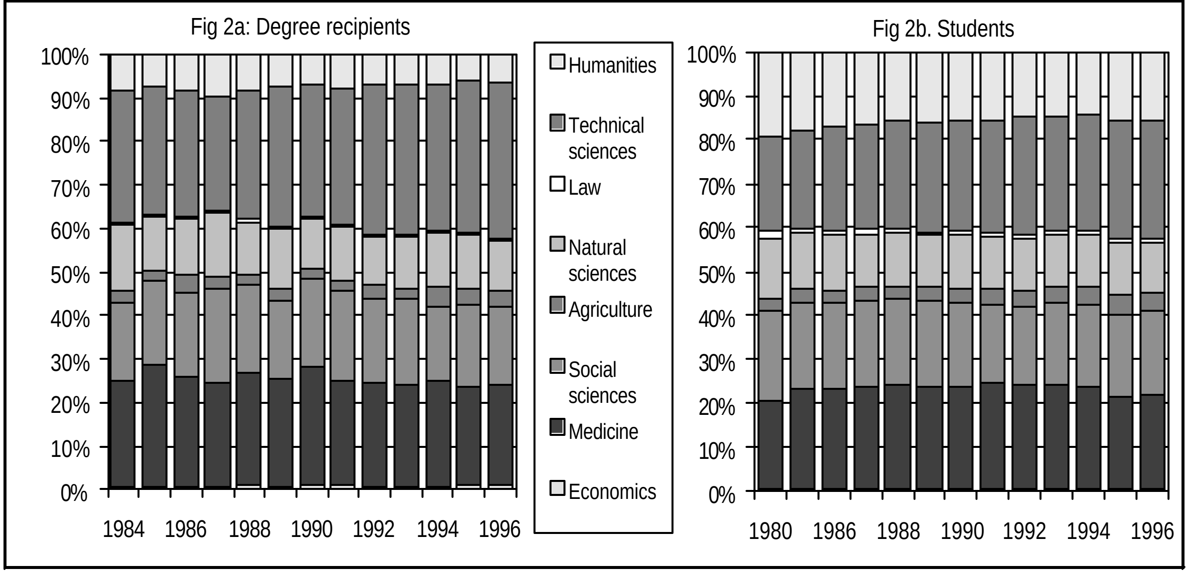
In figure 2, the numbers of postgraduate students and degree recipients are presented by discipline from 1980 until 1996. The large difference between the proportion of students and the proportion of graduates in certain fields indicates that a high percentage of graduate students do not complete the program or complete it more slowly; for example, compare the data for students in the social sciences versus those in the natural sciences.

Since the mid-1980s, the licentiate degree has been reintroduced as an intermediate qualification in postgraduate education. The standard time for completing this new degree is 2 years. The request for the new licentiate came primarily from engineering faculty, in which field a licentiate can be regarded as adequate preparation for work in industry. Most holders of licentiate degrees are in the technical sciences (computer science, mechanics, engineering, architecture, etc.) (figure 3).

As shown in figure 4, the number of licentiate and doctoral students has gone up considerably since the early 1980s. Also, although there is still a big difference between the number of students who enroll and the number of students who actually complete postgraduate studies, the difference has declined relatively.

The doctoral degree program in the current higher education system officially takes approximately 4 years

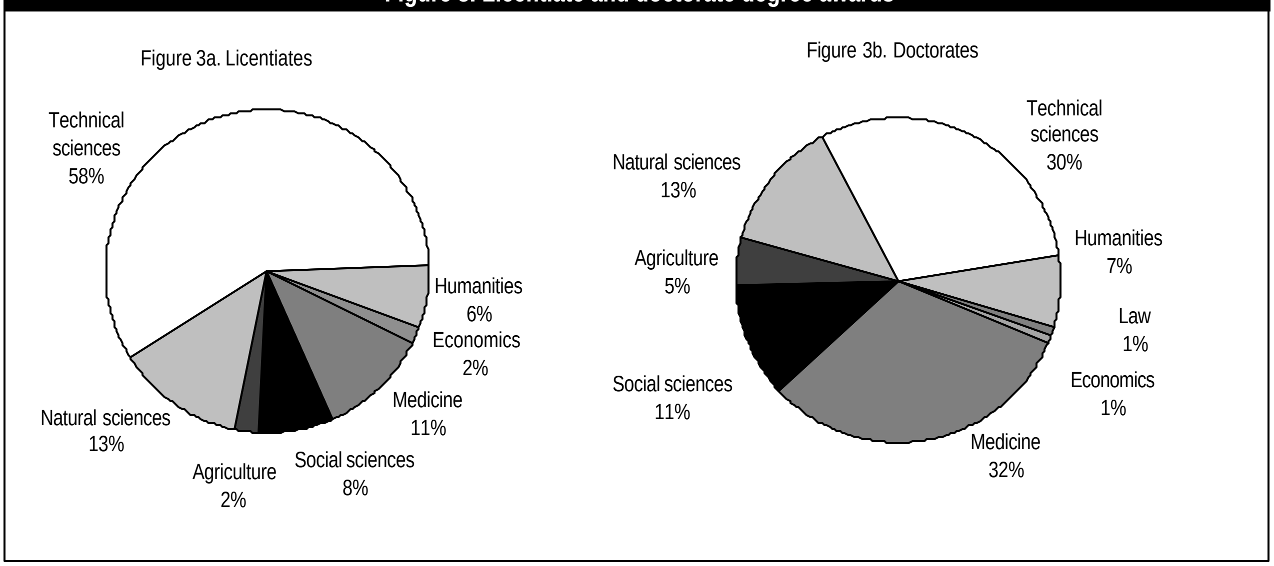
Figure 2. Postgraduate students and degree recipients by discipline



NOTES: Natural sciences includes physical, chemical, biological, and mathematical sciences. Technical sciences include engineering, mechanics, computer sciences, and architecture.

SOURCE: Statistica Centralbyrån (1997). Universitet och hogskolor Forskarutbildning: Nyantagna, registrerade och examinerade lasaret 1993/94, 1995/96, and 1996/97. Örebro.

Figure 3. Licentiate and doctorate degree awards

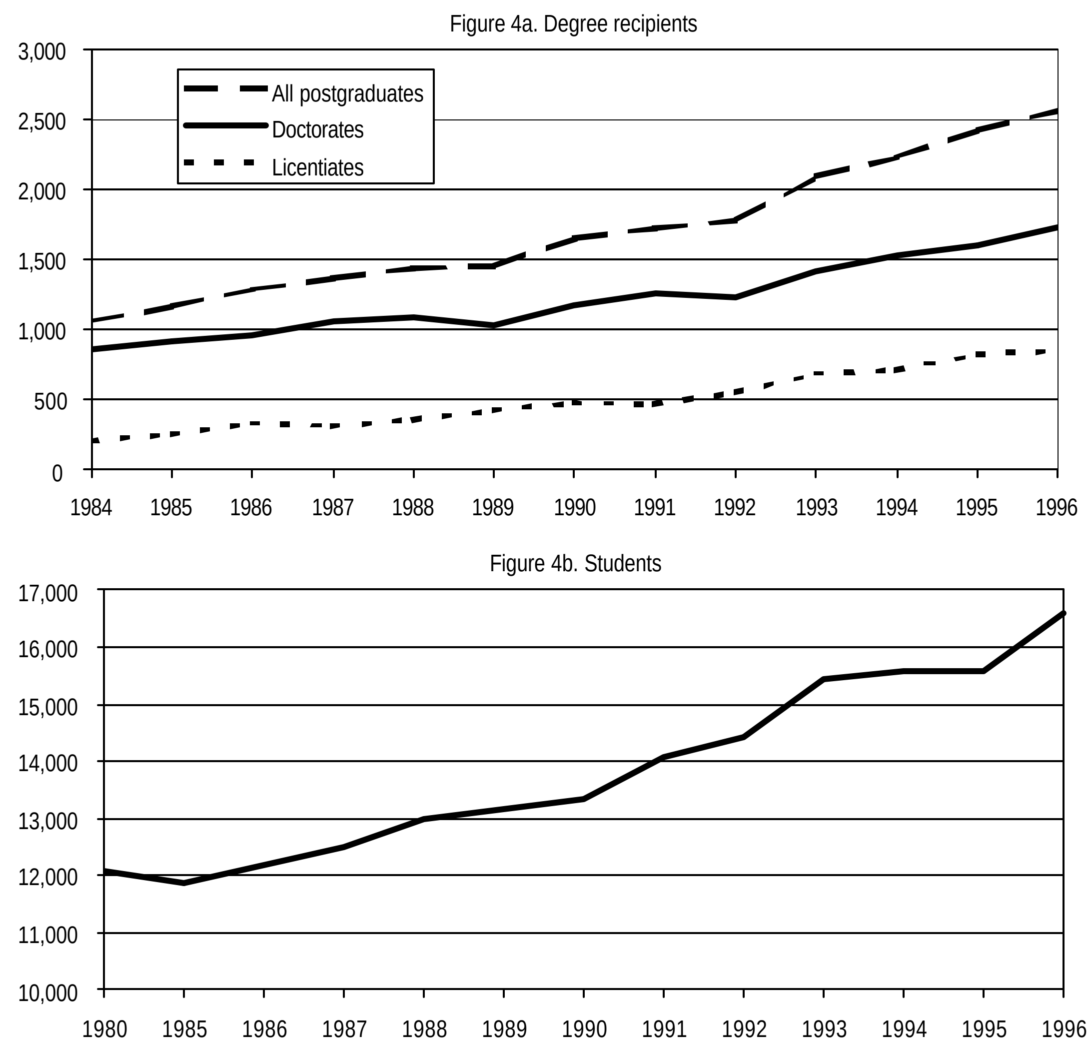


NOTES: Natural sciences includes physical, chemical, biological, and mathematical sciences. Technical sciences include engineering, mechanics, computer sciences, and architecture.

SOURCE: Statistica Centralbyrån (1997). Universitet och hogskolor Forskarutbildning: Nyantagna, registrerade och examinerade lasaret 1993/94, 1995/96, and 1996/97. Örebro.

to complete, which equals 160 study points. All graduate programs provide in-depth study in the field, training in methodology, and research experience. Required courses take about 1.5 years (60 points). The student, together with an advisor, decides upon a study plan and a topic for the dissertation during the first year; this must be approved by the department. Doctoral dissertations are usually written in Swedish or English, but may also be written in other languages. All postgraduate students receive individual tutoring. Dissertations must be defended in public before a committee. The thesis may be published as a monograph or as a composite dissertation consisting of a number of research papers and a summary.

Figure 4. Total number of postgraduate degree recipients and students



SOURCE: Statistica Centralbyrån (1997). *Universitet och hogskolor Forskarutbildning: Nyantagna, registrerade och examinerade lasaret 1993/94, 1995/96, and 1996/97. Örebro.*

The participation of women in graduate education in Sweden shows a consistent growth during the last decades, although the proportion of female students is higher than the proportion of female graduates (figure 5 and table 1).

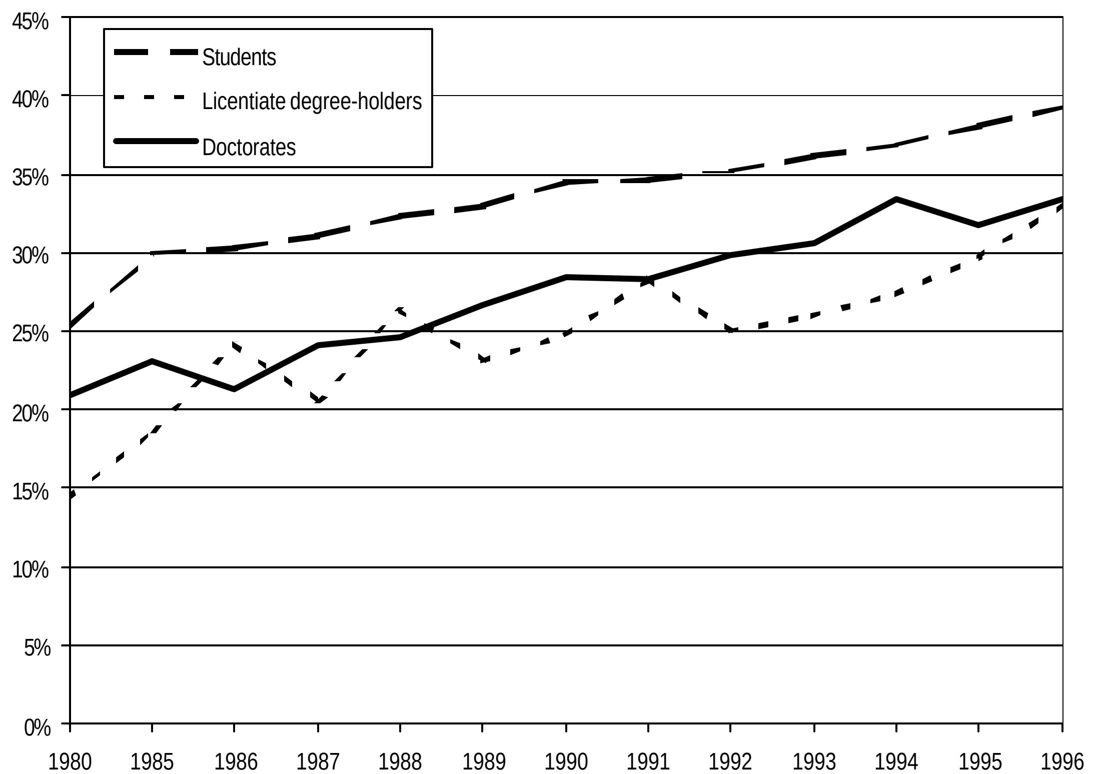
In the 1980s, the balance of the two main activities of the education sector—providing undergraduate education and conducting research—has shifted more toward research. During this decade, government appropriations for undergraduate education decreased from 40 to 30 percent of the total budget for universities and university colleges. During the same period, government grants for research and postgraduate education increased; even greater increases were seen in the funding from other sources.

In comparing the Swedish model with other systems of postgraduate education, a shift can be discerned from the apprenticeship model (e.g., of Germany) to the professional model (e.g., of the United States). Since the reforms of 1969, a considerable proportion of the current licentiate and doctoral programs have consisted of coursework and participation in seminars in the field or related areas. Research and dissertation work are mainly carried out in the final stages of the program.

Doctoral Reforms

As part of larger reforms in higher education in its entirety, graduate education has changed considerably since the Second World War. The doctoral education program introduced in 1969 was designed to boost the num-

Figure 5. Proportions of female postgraduate degree-holders and female postgraduate students, 1980-96



SOURCE: Statistica Centralbyrån (1997). *Universitet och hogskolor Forskarutbildning: Nyantagna, registrerade och examinerade lasaret 1993/94, 1995/96, and 1996/97. Örebro.*

Table 1. Number and percent of new female postgraduate students by major field

Field	1986-87		1989-90		1992-93		1995-96	
	Total number	Percent of women	Total number	Percent of Women	Total number	Percent of Women	Total number	Percent of Women
Total	2,260	32	2,450	34	3,470	35	3,100	40
Humanities	280	43	270	45	410	48	340	53
Social sciences	340	38	370	34	560	41	470	46
Medicine	490	37	560	38	760	41	780	48
Mathematics/natural sciences	220	27	300	35	390	38	310	39
Technology	570	21	570	20	780	24	760	24
Technology/natural sciences	120	28	120	26	160	32	150	32

SOURCE: Högskoleverket (1998b). *Women and Men in Higher Education.* Högskoleverkets Reports 1998:13 R.

ber of candidates, lower the average age of the candidates, and increase completion rates. This policy, however, did not lead to the expected results. In the 1980s, there were increasing concerns about the quality of Ph.D. education in Sweden. This resulted in a strategy focusing more strongly on quality and loosening the rigid formal requirements that gave priority to quantitative performance (Bleiklie 1993). In this period, government grants for Ph.D. education were increased, and doctoral students were provided an additional year of government support. The basis of most current reforms in postgraduate education can be traced back to the change of government in 1991. In the 1990s, education at all levels has become more decentralized. The new research policies introduced in 1993 involve changes designed to increase flexibility, efficiency, and competitiveness. Traditionally, Swedish researchers were supported by the government through basic research grants given to universities, personal grants from research councils, and grants from various applied science funding organizations. Additional sources of funding have been introduced to increase opportunities for supporting research in areas that are already on their way to becoming world class. Instead of focusing on specific fields, support is concentrated on specially gifted individuals and outstanding research environments.

The priorities of the new research policies, as described in the *1993 White Paper on Research* (Swedish Ministry of Education and Science 1993, p. 170), are:

- to strengthen links between universities and industries, and
- to increase efforts to promote concentrated and major world-class research projects.

Strengthening Links Between Universities and Industries

A major share of government spending on research is directed to universities, and not to specific research institutes. This university-focused orientation may cause problems in the exchange of knowledge between the university and business sectors. Therefore, a program to widen and deepen contacts between universities and industry is being introduced. This program consists of, among other things, an increase in the number of Ph.D.s in industry, the establishment of special research companies connected to the universities, and the introduction of special postgraduate programs in industry. The new research policies adopted in 1993 state that the new projects should include the training of young researchers.

Promoting Concentrated and Major Research Projects

For efforts to promote concentrated and major research projects, 10 billion SEK—to be used over a period of 15 years—has been allocated to promote internationally competitive research programs. This sum has been divided among three areas: 60 percent to strategic research (support for technical, scientific, and medical research); 25 percent to strategic environmental research; and 15 percent to research in the humanities and social sciences (Swedish Ministry of Education and Science 1993). Furthermore, special "centers of excellence" have been established at universities and university colleges. These centers are financed by the Swedish Industrial and Technical Development Administration.

Further policy measures focus on flexibility, recruitment, and internationalization. Flexibility is considered necessary to develop creative research environments and to cope with the rapid advancement of knowledge. Increased autonomy and pluralism within the university system should create opportunities to achieve this. The recruitment of additional researchers is important both for the development of Swedish industry and for the promotion of quality in university education and research. A specific program has been introduced to support the recruitment of women into higher education and research. Finally, a number of measures have been undertaken to extend international relations in Swedish research.

During the 1980s, there were discussions as to whether there was a need for a special agency at the faculty level for planning and leading research training on the model of American graduate schools. However, these suggestions didn't receive strong support at the universities, and some institutions have developed their own agencies for research training. The discussion about an agency at the university or faculty level was renewed by the *1993 White Paper on Research*.

The reforms presented above should lead to the creation of a higher education structure that can deal with future challenges. Following the creation of such a structure, the transformation of Sweden's educational and research systems is to be carried out in a project entitled "Agenda 2000, Knowledge and Competence for the Next Century." This project maps out a strategy to link together policies for schools, universities, and research. It is based on the belief that governments and parliaments should not interfere with educational and research systems by regulating and deciding on minor details, but should concentrate instead on encouraging individuals to strive for excellence.

Patterns of Support

Before the 1980s, postgraduate students were financed out of the research appropriation to which each university faculty was entitled. The way the money was spent was decided by the faculty board of the individual institution. The board could decide to spend it on positions for postgraduate studies or on fellowships. The students with posts were to spend the majority of their time on research, but could combine this with teaching. Fellowship-holders could combine research studies with a job on a research project or a part-time job as a teaching or administrative assistant. Another possibility for financing postgraduate studies was to combine one's studies with research on a project funded by external sources or by one of the research councils. Some educational institutions required that students participate in teaching and administration. Although there were great differences across faculties in the application of the regulations, postgraduates typically were either required to work as teaching assistants or volunteered to use about 20 percent of their time for teaching. This was paid work in addition to the normal sources of financial support they received.

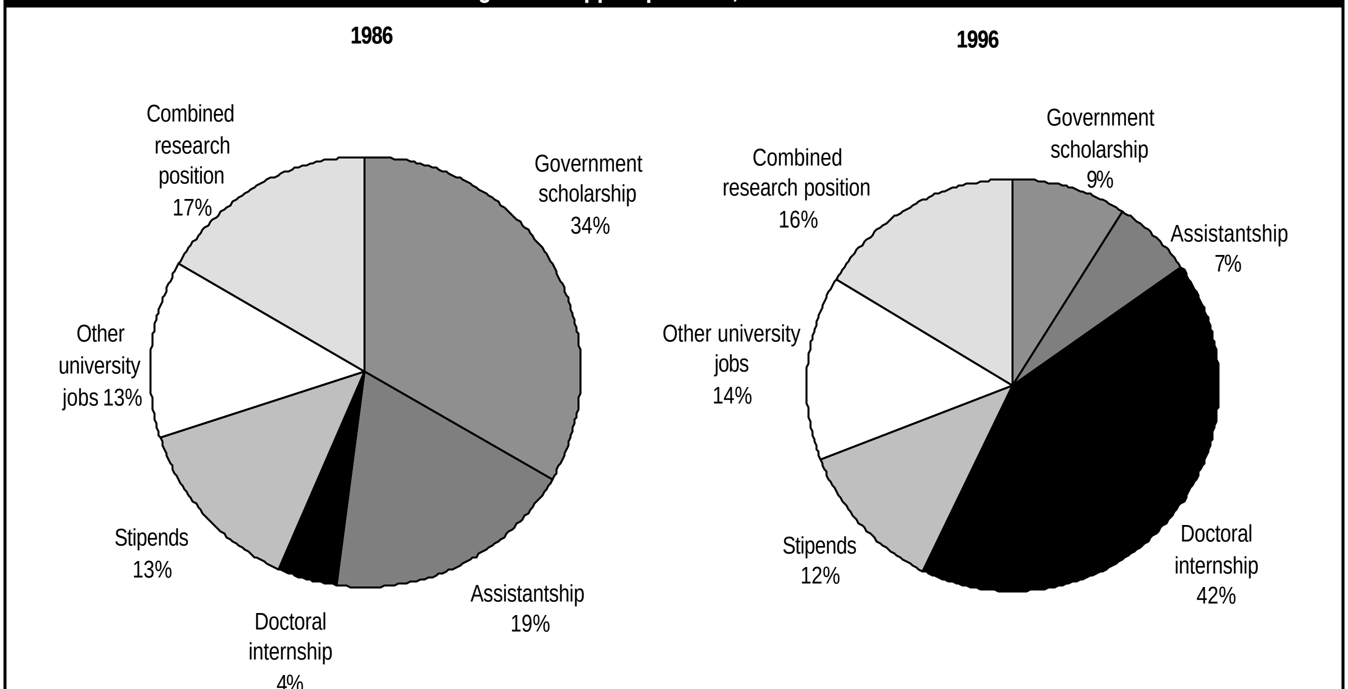
In 1982, the system for financial support of postgraduate students was changed from study grants to what is called *doktorandjänster*. These are doctoral internships by which students are temporarily employed at the university with full benefits and a salary corresponding to a starting salary in the public sector. Another way of funding students is the *utbildningsbidrag* (stipend), which gives students a lower gross income and poor benefits. In addition, some students finance their studies through work, loans, or scholarships. In 1994, of those who received funding for doctoral studies, 59 percent had a *doktorandjänst*, 16 percent had an *utbildningbidrag*, and 25 percent used another funding mechanism. Figure 6 shows that the proportion of postgraduate students supported by a *doktorandjänst* has grown rapidly from 1986-96, mainly at the expense of government scholarships and assistantships.

The availability of financial support varies by discipline. In figure 7, different types of financial support are presented for the different disciplines.

Funding has had a considerable impact on postgraduate completion rates (Zetterblom 1993). Completion rates differ greatly across groups of postgraduate students with different amounts of financial support. In the fields with the lowest rates of completion, the humanities and social sciences, about half of the students received no financial support from the university. In the natural sciences, the corresponding figure is only a fourth. With the exception of students in the clinical subjects of medicine, the completion rates were low among students who received no support. In the humanities and social sciences, the completion rate of this nonsupported group was about 5 percent; for the group most favored with study support, this proportion was 40 percent (table 2).

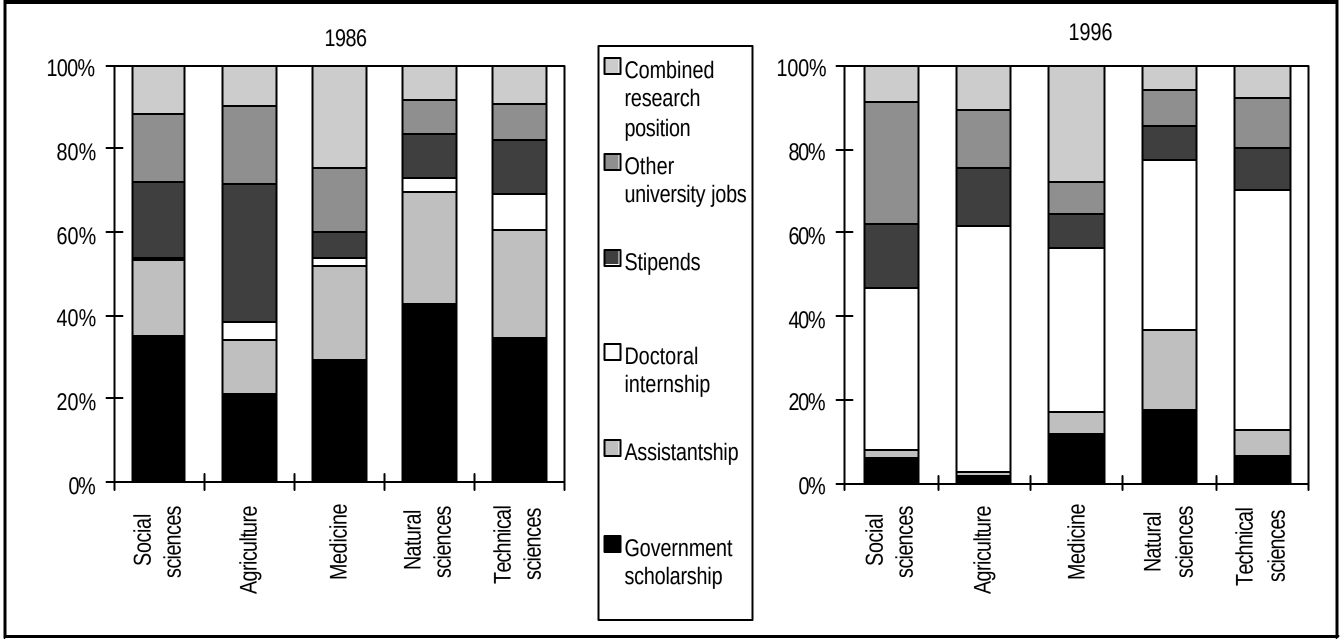
Various reasons may explain the differences in completion rates between groups with different amounts of study support. Of great importance seems to be the opportunity to perform research work on a full-time basis. In addition, the requirement of yearly applications for grants or assistantships stimulates substantial progress in their studies.

Figure 6. Support patterns, 1986 and 1996



SOURCE: Statistica Centralbyrån (1997). *Universitet och hogskolor Forskarutbildning: Nyantagna, registrerade och examinerade lasaret 1993/94, 1995/96, and 1996/97. Örebro.*

Figure 7. Availability of financial support by discipline, 1986 and 1996



SOURCE: Statistica Centralbyrån (1997). *Universitet och hogskolor Forskarutbildning: Nyantagna, registrerade och examinerade lasaret 1993/94, 1995/96, and 1996/97. Örebro.*

Table 2. Proportion of students with a doctoral degree after 13 years (admitted in cohorts of 1972-73 to 1977-78), by field

Field	Regular support ≥ 3 year	Regular support < 3 years	No study support	Total
Humanities	41	24	6	18
Social sciences	40	23	5	19
Natural sciences	71	39	20	50
Medicine, theoretical	82	45	56	67
Medicine, clinical	70	66	59	63
Engineering	57	27	18	36

SOURCE: Zetterblom, G. The Development in Graduate Eduacation in Sweden. Paper presented at the Sixth CHER Conference, July 1-3, 1993, Stockholm.

In 1998, the rules for funding postgraduate studies were modified. Now, only applicants employed in a postgraduate post or awarded a study grant may be admitted to postgraduate training. In other cases, the applicant must have guaranteed study funding for the whole period of study.

Employment Patterns

The rapid growth of postgraduate students in the 1960s raised concerns about the opportunities for graduates to find suitable employment in the future. A government committee set up to develop a system for quantitative planning proposed an elaborate system for balancing supply and demand in postgraduate education. The plans to implement such a system, however, were cancelled, as the rising growth of postgraduate students appeared to be temporary. In the 1980s, the attention given to the relation between the labor market and postgraduate education was based on more qualitative considerations. In the last decade, government policy has mainly been directed at stimulating cooperation between industry and research to train high-quality researchers.

There is little quantitative information available on employment of Ph.D.s in Sweden. We therefore give some rudimentary figures. Statistics show that almost all of the new doctoral degree-holders from 1991-92 were employed in 1994 (Kyvik and Tvede 1998). Fourteen percent were unemployed during parts of this period from 1991-94. There are large differences in the percentages of postgraduates from different disciplines who are employed by universities. Around 1980, over 50 percent of all Ph.D.s in the social sciences were employed by a university. The corresponding rates for recipients of doctorates in the humanities and natural sciences are between 40 and 50 percent. The smallest proportion of postgraduate degree-holders employed in universities can be found within the clinical subjects of medicine (Zetterblom 1993).

Patterns of International Mobility

In the 1980s, most Swedish universities developed their own plans of action to set priorities for internationalizing curricula and research networks. In 1993, however, the Royal Swedish Academy of Sciences stated that too few researchers—including postgraduate students—engaged in research stays abroad and that this situation should be changed. The government supported this view and recommended the use of existing bilateral agreements, programs, and networks; it also advised that special attention be given to the development of shorter courses, summer schools, etc. In addition, the universities themselves were expected to be responsible for enhancing the internationalization of research training.

A general trend toward the internationalization of education and research can be detected in Sweden. For example, the proportion of Ph.D. graduates in Sweden with a first degree from another country grew from 3 percent in 1973-74 to 19 percent in 1993-94. In 1994, there were almost 1,000 incoming people—both temporary and permanent residents—with postgraduate education in Sweden, compared to 340 persons outgoing. For outgoing students, the United States seem to be the most popular country to stay abroad. In addition to language reasons, students claim that the best research environments in their fields are in the United States. In Europe, the United Kingdom, Germany, and France are the most popular countries. Only 3 percent of the students going abroad chose to study in Africa, Asia, or Latin America.

With respect to the internationalization of research training, the regional cooperation between the Nordic countries in postgraduate education is especially remarkable. In 1990, the various Scandinavian countries tried to further their cooperation by establishing the Nordic Academy for Advanced Study. This organization currently funds approximately 6,000 research students and researchers involved in cooperative Nordic projects. The objective of this cooperation is that the Nordic countries function as one common research training region. Graduate students will thus have the opportunity to make use of courses in countries other than their home country.

ACKNOWLEDGMENTS

The authors wish to thank Petra Boezerooy, Frans Kaiser, and Anne Klemperer from the Center for Higher Education Policy Studies Higher Education Monitor Unit for the statistical information provided.

References

Bleiklie, I. 1993. Norwegian and Swedish Graduate Reform Policies. Paper presented at the Sixth CHER Conference, July 1-3, 1993, Stockholm.

Högskoleverket (National Agency for Higher Education). 1998a. *Swedish Universities and University Colleges 1997*. Short version of annual report.

———. 1998b. *Women and Men in Higher Education*. Högskoleverkets Reports 1998:13 R.

Kyvik, S., and O. Tvede. 1998. The Doctorate in the Nordic Countries. *Comparative Education* 1: 9-25.

Statistica Centralbyrån. 1997. *Universitet och hogskolor Forskarutbildning: Nyantagna, registrerade och examinerade lasaret 1993/94, 1995/96 and 1996/97*. Örebro.

Svanfeldt, G. 1994. Higher Education Policy in Sweden. In L. Goedegebuure et al., eds., *Higher Education Policy: An International Comparative Perspective*. Oxford: Pergamon Press.

Swedish Ministry of Education and Science. 1993. *Knowledge and Progress: A Summary of the Swedish Government's Bill on Higher Education and Research* (*White Paper on Research)*. Government Bill 1992/93. Stockholm.

Zetterblom, G. 1993. The Development in Graduate Education in Sweden. Paper presented at the Sixth CHER Conference, July 1-3, 1993, Stockholm.

United Kingdom

Jeroen Bartelse, Eric Beerkens, and Peter Maassen

Introduction

In the post-war period, the British higher education system experienced a major expansion. By the end of the 1950s, however, it became clear that the route pursued was not going to yield the expansion the system actually required. This was mainly because universities raised their entry requirements to cope with increased demand, rather than accommodate larger groups of students within the existing infrastructure. These growing tensions resulted in the establishment of the Robbins Committee to inquire into the future of higher education. The report published by this committee stated that "all young persons qualified by ability and attainment to pursue a full time course in higher education should have the opportunity to do so" (Committee on Higher Education 1963, p. 49). This reflection provided a guide for the development of the British higher education system thereafter. During the 1960s, several new universities and a wholly new sector of higher education were established. Despite the recommendations of the Robbins Committee, further expansion of higher education did not take place in the universities but mainly in the newly established public sector in higher education: the polytechnics and colleges. This binary system lasted until 1992, when the polytechnics were granted university titles.

Virtually all institutions in British higher education offer the 3-year bachelor's degree program; most also offer postgraduate degrees leading to master and doctoral qualifications. Undergraduate education consists of 3-year programs. These can be concluded at different levels: the lowest level is the bachelor "pass-degree," and the highest level is the bachelor "first-class honors degree." Overcrowding in the undergraduate programs and a decrease in standards have resulted in an inadequate inflow into graduate education—and, consequently, have led to a discussion about extension of undergraduate programs to 4 years. Following undergraduate education, three types of graduate programs are offered leading to three types of qualifications: postgraduate diplomas; master's degrees (the so-called "taught master's," which are curriculum based, and the research master's degrees); and doctoral degrees (figure 1). This country report discusses graduate education in the United Kingdom and focuses specifically on the doctoral degree.

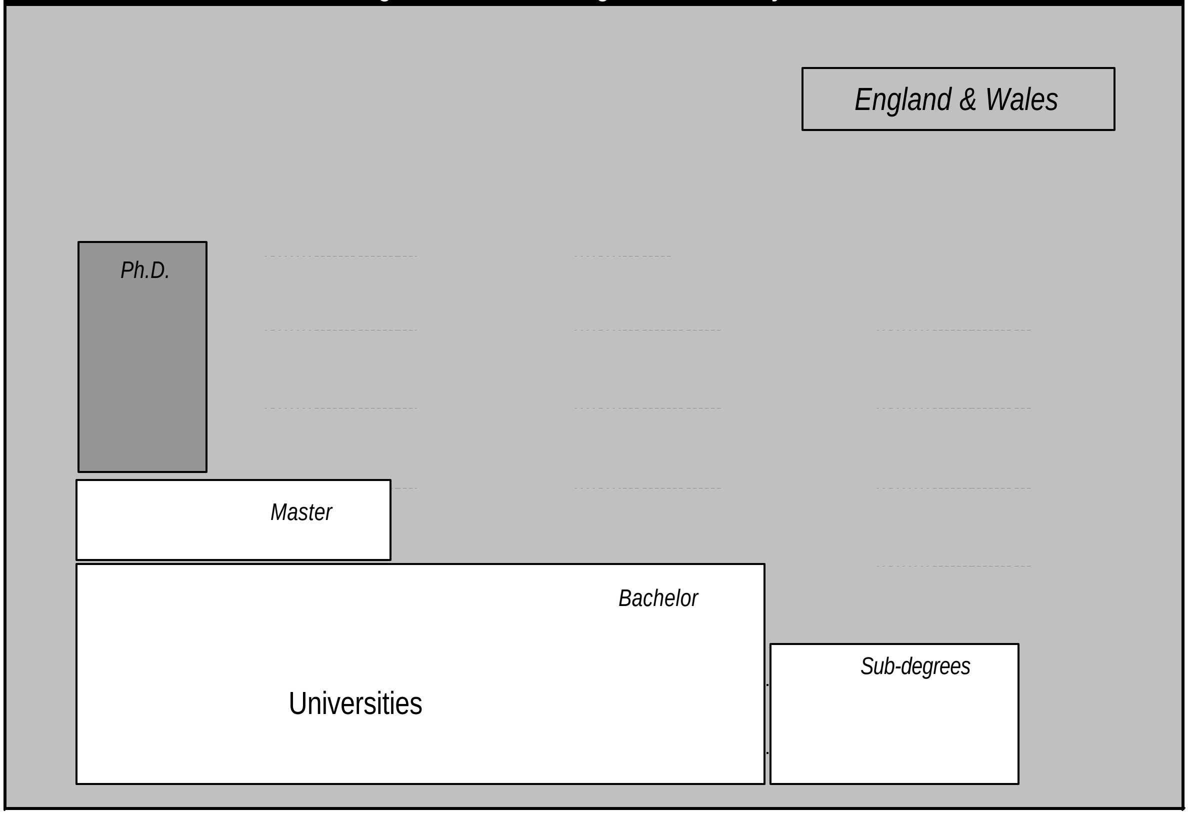
The next section discusses trends in graduate education in the United Kingdom. This discussion is limited to policy developments up until the late 1980s and the effects of these policies on the current number and division of graduate students. Following this, the various policy papers issued in the 1980s and 1990s are discussed. These papers form the basis of the actual reforms that are still ongoing at this time. Finally, support patterns, employment patterns, and international mobility are discussed.

Trends in Graduate Education

In the binary higher education system of the United Kingdom, universities were supposed to maintain their traditional academic role, including basic research; while public sector institutions were meant to develop vocational types of higher education. The polytechnics, however, took a more complex view of their role in the system, striving to become more equal to, and less different from, the universities. After the polytechnics were granted university titles in 1992, the binary system practically changed into a unitary system: 74 universities enroll 90 percent of all students in higher education, and 143 other institutions provide education for the remaining 10 percent (Brennan and Shah 1994).

In general, the British higher education system, both in the past and in the present, can be characterized as specialized, elitist, small-scale, and focused on first degree provision (Becher 1993). Two universities, Oxford and Cambridge, monopolized higher learning in England for six centuries, until the foundation of the Universities of London and Durham in the second quarter of the 19th century. In 1917, Oxford was the first British university to introduce the Ph.D., largely to attract American scholars away from Britain's wartime enemy, Germany (Simpson 1983). Professors had begun to incorporate research work into their own activities, but still research was considered subordinate to teaching activities, rather than the basis of professorial orientation and university organization. This might account for the moderate integration of the Ph.D. degree in the British system. In 1938, there were only 3,000 postgraduates in British universities; these represented only 6 percent of the full-time total student population.

Figure 1. The British higher education system



Although the number of doctoral graduates has grown rapidly during the several decades following the Second World War, its growth was considerably slower than in most other countries in Europe. In the *Robbins Report* of 1963, therefore, expansion of participation in graduate education was recommended. The committee gave two reasons why these increases were needed. First of all, there should be more graduate students in order to provide more teachers for the rapidly expanding system of higher education. Second, more students were needed to keep up with the fast pace of change in the scientific and technological revolution. It was assumed that the demand for people with graduate degrees would increase with supply.

The *Robbins Report* proposed a new structure for graduate degrees, in which a 3-year Ph.D. would follow a 1-year master's degree program. The reforms proposed in this report emphasized the importance of a close relationship between graduate education and the labor market. It was envisioned that American graduate schools would be copied in terms of training through formal instruction and seminars. This way, doctoral students would no longer be dependent on a single supervisor. After the *Robbins Report*, governmental statements on graduate education were largely absent. In 1982, the Association of British Research Councils published the *Report of the Working Party on Postgraduate Education*, better known as the *Swinnerton-Dyer Report*. This report called for labor market information and employment trends to be taken into consideration when deciding upon the number of grants to be allocated by the research councils. Like the *Robbins Report*, the *Swinnerton-Dyer Report* also recommended the inclusion of coursework as part of the doctoral program.

In the late 1980s, there was a shift in power concerning research and science policy from leading academies, the funding bodies, and the research councils to the government. The British government started to play a more definitive role in the setting of research objectives. These developments and the various papers issued in the 1990s (discussed later in this report) form the basis of the current graduate education system.

The commitment to personal teacher-student relationships still exists in this system. The British approach to university organization does not focus on research as a primary university activity, prevailing over teaching and study, as it does in Germany. The orientation toward research came rather late and was mainly a reaction to scientific progress and improvement in research training and research in other countries. Research gradually developed into a standard and subsidized component of faculty activity.

Nonetheless, in terms of number of students, the training component in research has remained relatively underemphasized in British universities. It generally involves a few carefully chosen students who conduct research in a close relationship with their mentors. This has resulted in a doctoral program with little or no curricular provision. Most graduate students register for the Ph.D., which normally requires 3 years of full-time study. Some students register with the intention of obtaining a master's degree, usually either a master of arts or a master of science taken full time in 1 year, or a master of philosophy taken full time in 2 years.

In the current system, only students who achieve a bachelor first-class or upper second-class honors degree are admitted to a graduate program, although exceptions are made for people with relevant professional experience. Admittance to a graduate program occurs in two stages. The first stage is the provision of a studentship (scholarship) by the British Academy or a research council, in which the results of the undergraduate career are taken into account. Second, the student has to be accepted by the department. Expectations regarding time to completion of the program and chances of success of the research proposal are leading criteria for admission by the institutions (Kaiser, Hezemans, and Vossensteyn 1994).

Small size, selectivity, and high quality go together along with personal relations between teacher and student. This apprenticeship model has been a major characteristic of the British system and has the advantage of being easy to operate, with clear lines of responsibility between student and supervisor. The theses produced are made publicly available and consist of a monograph or series of selected papers in learned journals.

Within the various disciplines, there are important differences in this traditional model. In the natural sciences, a graduate student joins a research team and works on a research thesis while contributing to the overall efforts of the group. In the humanities and social sciences, however, students normally select their own topics and work independently. Formal contact is much greater in science departments.

As a result of the reforms in the higher education system in the early 1990s, the number of university graduate students boomed between 1993 and 1994. As the polytechnics were awarded the university title, the number of taught master's degrees, in particular, showed a large increase (figure 2). With the expansion of the number of universities, and therefore of the number of accrediting institutions, taught master's degrees are being offered in more institutions than before the 1993 reforms.

Figure 3 shows the enrollment of graduate students in various disciplines, broken down by year. The differences on either side of 1993 can be explained by the higher education reforms implemented at that time. Figure 4 shows the differences in enrollment across various disciplines for taught (curriculum-based) programs and research-based programs.

The enrollment of women in graduate education shows a steady increase in the past decade (figure 5). Currently, the numbers of male and female graduate students are practically equal.

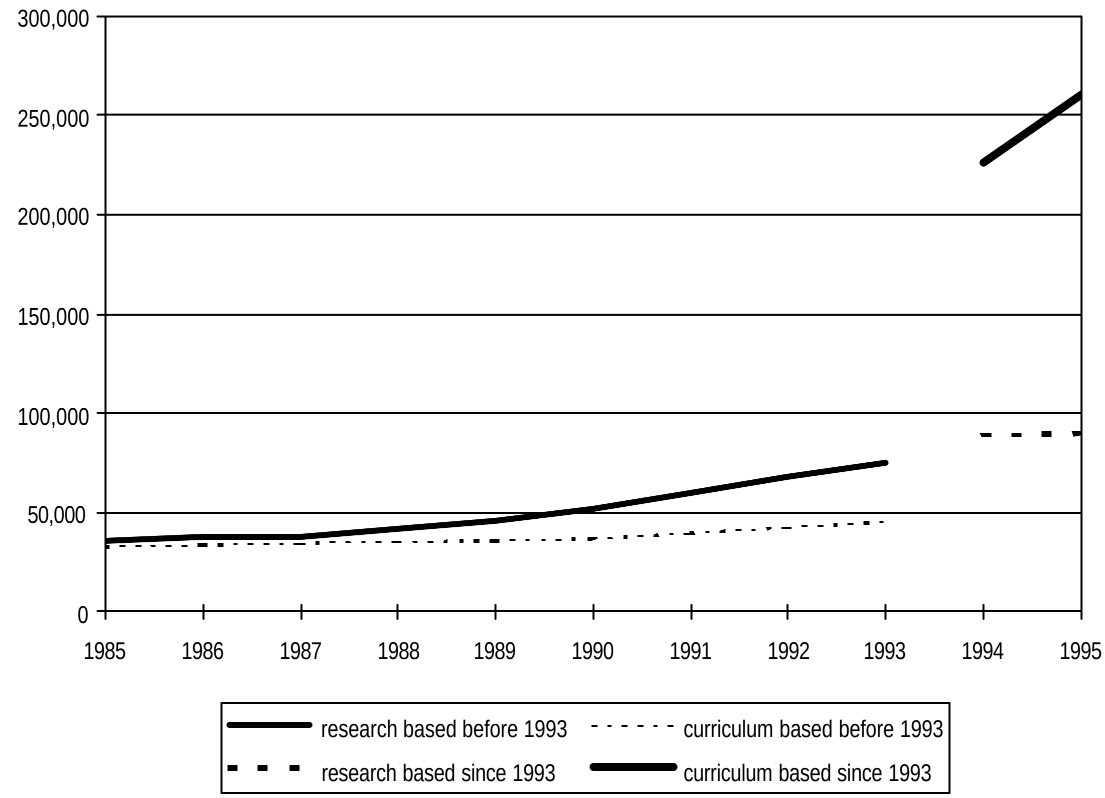
In figure 6, doctoral degrees and total graduate degrees awarded in 1994 are presented by discipline. Figure 7 shows number of doctorates by discipline.

Doctoral Reforms

While government interference was relatively absent between the publication of the *Robbins Report* in 1963 and the *Swinnerton-Dyer Report* in 1982, the role of government in graduate education increased considerably at the end of the 1980s. Until 1993, this was mainly through references to graduate education in general papers about higher education. The policy statements show a consistent interest in linking the number of graduate students to labor market demands. Therefore, an interest in the content of graduate education and its relevance to the needs of industry and commerce were incorporated in the policymaking process. At the same time, the relevance of basic research, which contributes to fundamental knowledge, was recognized. In this section, the reforms in British graduate education—which are still going on—are examined on the basis of the various policy documents issued in the 1980s and 1990s.

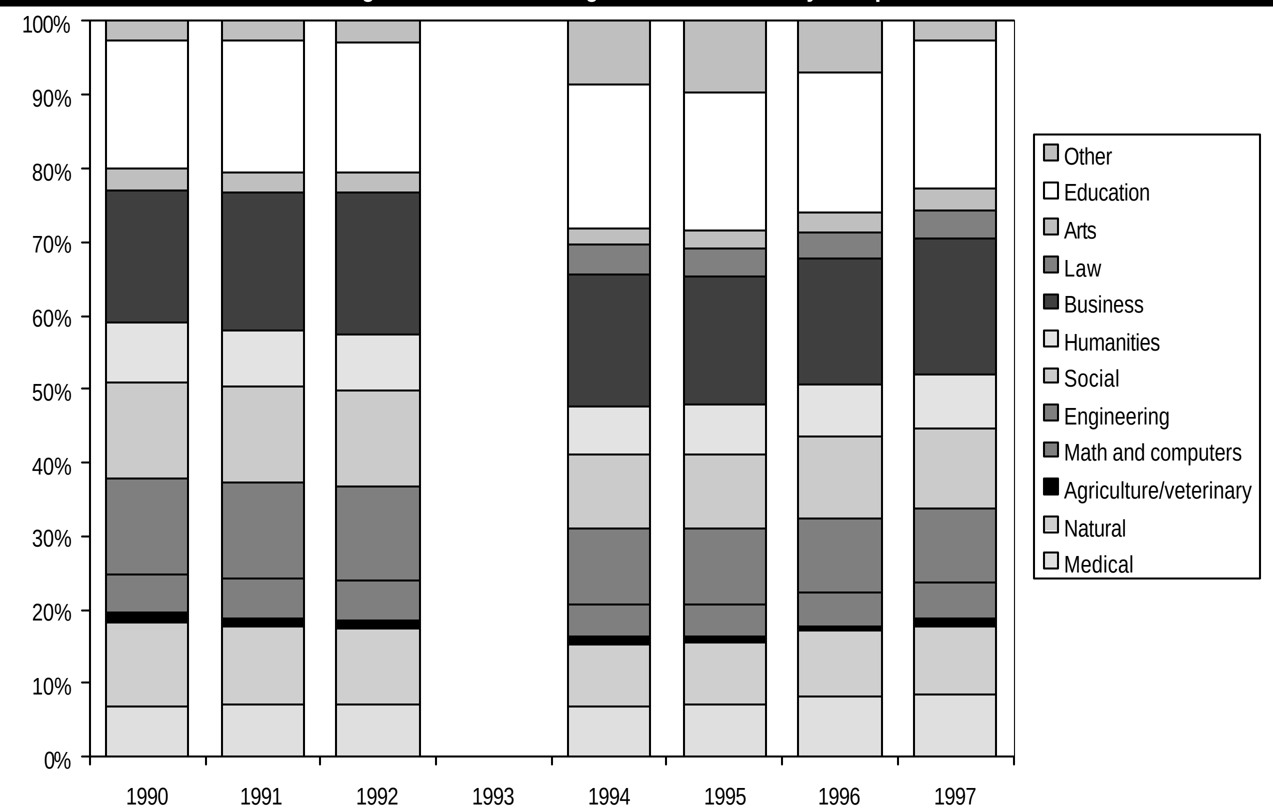
Many of the changes to the British traditional apprenticeship model have been inspired by the American graduate education system. This latter system places more emphasis on teaching as a means of introducing substantial elements of training. Furthermore, it is a system in which teams of academics act as advisors for Ph.D. projects. Some of these practices have recently appeared

Figure 2. Enrollment in graduate education



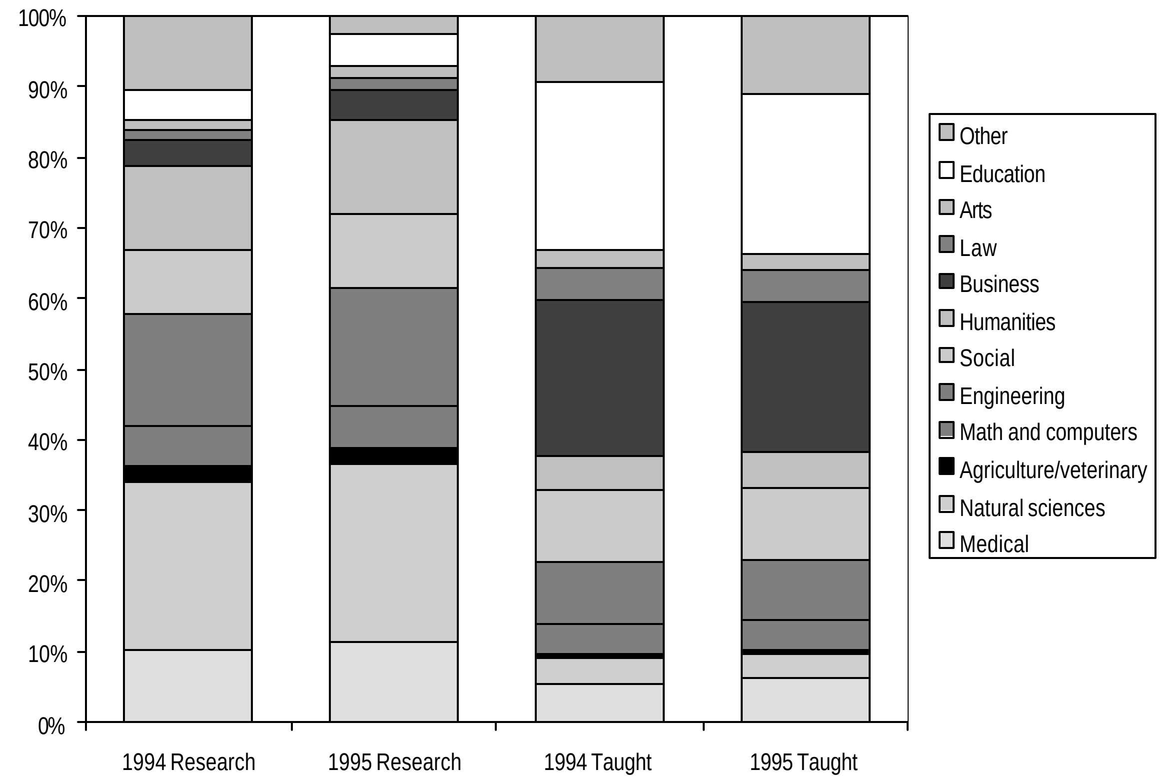
SOURCE: Higher Education Statistical Agency.

Figure 3. Enrollment in graduate education by discipline



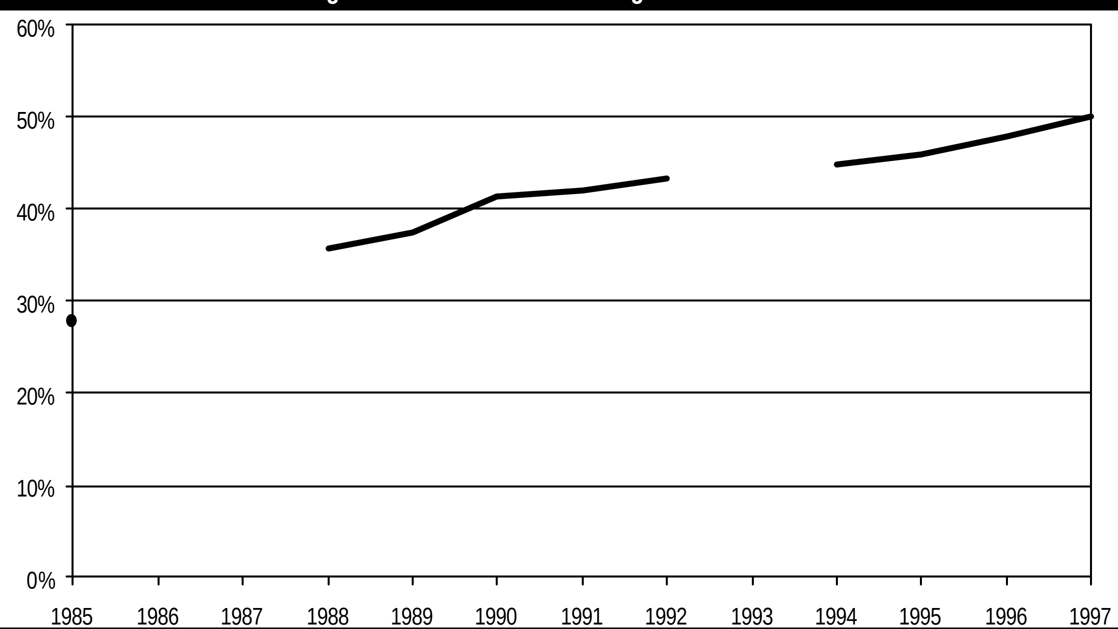
SOURCE: Higher Education Statistical Agency.

Figure 4. Postgraduate enrollment by course and discipline in 1994 and 1995



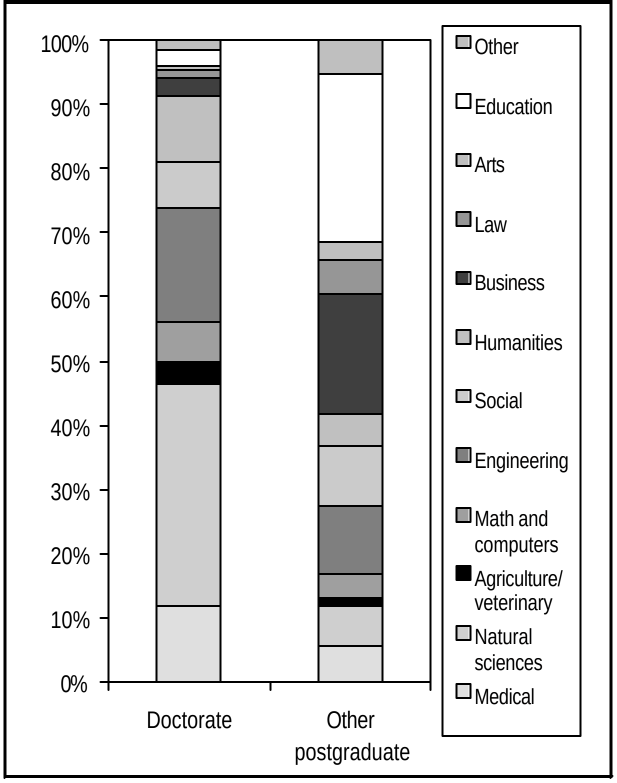
SOURCE: Higher Education Statistical Agency.

Figure 5. Female enrollment in graduate education



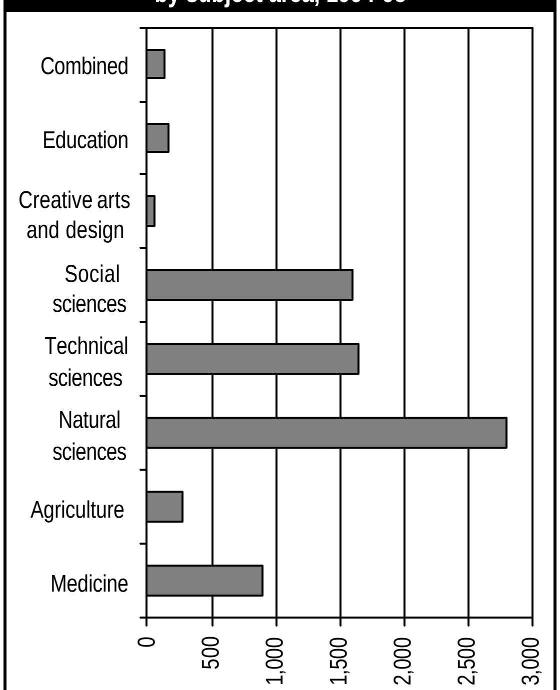
SOURCE: Higher Education Statistical Agency.

Figure 6. Degrees awarded in 1994 by discipline



SOURCE: Higher Education Statistical Agency.

Figure 7. Number of doctorates awarded by subject area, 1994-95



SOURCE: Higher Education Statistical Agency (1998c).

in the United Kingdom, as efforts have been made to incorporate coursework into the Ph.D. program. These courses are designed to broaden students' perceptions of their disciplines, but also to teach the research skills needed to complete a research thesis. Since the *Swinnerton-Dyer Report*, the debate about research training—and hence the criticism about the traditional model—has mainly been about the length of time to degree and the poor submission rates of Ph.D. theses, and about the elements of training to be incorporated into the Ph.D. program. These are addressed below.

Submission Rates and Program Length

In its report, the Advisory Board of Research Councils recommended that full-time Ph.D. students should complete their program within 4 years. The traditional Ph.D. was being criticized as overly ambitious, and the board suggested that topics should be defined so that completion within a 4-year period would become feasible. The reasons the report gave for poor completion rates were as follows (ABRC 1982):

- poor supervision, especially in the early stages;
- lack of adequate knowledge of research techniques; and
- low student motivation.

Since the publication of the report, the research councils have introduced a sanctions policy to improve national submission rates by disqualifying departments or universities with a low number of students submitting a thesis within 4 years of receiving financial support. The attention to submission rates was caused by reasons concerning funding of graduate education and by the future employment prospects of Ph.D.s (Burgess et al. 1995). Concern has been expressed about the large amount of government funding used to support research students for 3 years of full-time study when the return on this investment, in terms of completed Ph.D.s, is low. Furthermore, it was recognized that, in an environment of limited job opportunities in higher education, it was in the students' best interest to complete as quickly as possible.

Training Process in the Ph.D. Program

The question of whether the education and training process in the Ph.D. program should be emphasized has been a much-debated issue. According to the Committee of Vice Chancellors and Principals of British universities, the Ph.D. should be both a *product*—an original contribution to knowledge—and a *process*, involving the training of a researcher. The only way to accomplish this goal within 4 years is to define the thesis topic carefully and to accept the notion of a Ph.D. program with formal training elements complementing the original research work. This structure was regarded as a way of broadening the narrow, traditional Ph.D., while helping to improve completion rates. Critics of this approach note that it is difficult to combine both formal training elements and research into a coherent package. There have also been suggestions that the Ph.D. thesis should be replaced by a series of research papers on a variety of topics linked to a central theme. However, the idea of a single thesis making a substantial contribution to a discipline is considered a powerful concept which seems likely to remain dominant (ABRC 1982).

The main participants in this debate were the funding councils and the higher education institutions. Much of the pressure to reform the graduate research training process in the 1980s came from agencies responsible for funding training rather than from the universities that provided the training. There was considerable opposition within universities to the introduction of the research councils' sanctions policy and considerable argument about the nature of the Ph.D. Now that a consensus has been reached over the fundamental requirements of the Ph.D. (an original contribution to knowledge carried out as part of a research training process in a fixed period of time), the debate has moved on to the functioning of institutional policies and practices. Questions have been raised as to whether these policies sufficiently contribute to the production of trained researchers. The academic structures of most institutions were developed primarily to cater to undergraduates. Graduate education is mainly still managed as an extension of undergraduate programs, often without the necessary resources. In addition to its structure, the size of graduate training programs might create problems. Many departments are too small to support a doctoral program with a thriving graduate community (Burgess et al. 1995).

After the release of the *Swinnerton-Dyer Report*, the government remained rather quiet about graduate education until the early 1990s. In a 1993 White Paper on Research, *Realising Our Potential*, the Technology Foresight Initiative was announced; its intent was to bring together the industrial community and the communities of science and engineering. In this report, attention is paid to the relationship between higher education and the research base. Part of the Technology Foresight Program was a wide-ranging consultation of panels representing key sectors of the economy. Although many issues raised by this consultation have a general rather than a specific relevance to graduate education, some of the wider concerns might have implications for graduates in terms of funding structures and priorities for research topics. The specific objectives of the Technology Foresight Program were as follows:

- to encourage close interaction and networking between the science, engineering, academic, business, and government communities;
- to build a common understanding between these communities of the challenges, concerns, and emerging opportunities in markets and technologies; and
- to provide guidance on priority areas of the 1993 white paper.

In the mid-1990s, two committees were key in the development of graduate education. Their reports were named after their chairmen: the *Harris Report* (HEFCE, CVCP, and SCOP 1996) and the *Dearing Report* (National Committee of Inquiry Into Higher Education 1997). The *Harris Report* focused solely on graduate education and recommended a framework of degrees, specifying the length, level, and title of each program; it also noted that there should be sufficient public funding to support graduate students. The *Dearing Report*, on the other hand, focused on the entire higher education sector and hardly mentioned graduate education in particular. It did, however, endorse the recommendations of the Harris Committee. One of the recommendations in this latter report was to develop a framework of standardized degrees and qualifications, and to increase the transferability of credits between institutions. It was put forward that master's degrees should be standardized and awarded only at the graduate level. The standardization of degrees should prevent this diverging range of recognition of degrees. The committee further recommended taught program degrees.

According to Blume (1995, p. 29), "graduate training is being gradually decoupled from its traditional association with an academic career toward education and training." The U.K. research councils have developed a number of schemes, which include a variety of relationships between students, industry, and educational institutions. The production of original research, however, remains central to the purpose of graduate education. The current challenge is to ensure high-quality training in research (given political priorities and financial constraints) that emphasizes both product and process (Burgess, Band, and Pole 1998).

In general, one might say that universities have made efforts to reform graduate education. There has been a move away from the apprenticeship model toward a program of research training that includes coursework, the appointment of joint supervisors, and a careful monitoring of progress by a research committee. Most institutions now have strict limits on the length of the research thesis. To ensure and control the quality of graduate education, some institutions have looked at the American graduate school model. In the early 1990s, a few graduate schools were established in the United Kingdom; presently, there are indications that certain other institutions will also change the administration of graduate education. In 1992, the chairman of the Advisory Board of Research Councils stated that (Ince 1992, p. 18):

> The idea of British graduate schools represented a strand of thinking which is now becoming quite common. A new center of gravity has to be found which gives a greater role to the research mentality. Leading universities increasingly need to be places that think of themselves as producers of research and as centers of systematic research training instead of places that happen to do some research and research training alongside their undergraduate training.

Changes in this direction are being made, but are still in progress.

Patterns of Support

Public funding for graduate education comes mainly from two sources: the funding councils and the research councils. The funding councils do not provide financial support for graduate students but provide the capital and some of the equipment for both research and teaching. The research councils make grants available for research and studentships for graduate education. Sources of support for postgraduate students in 1996-97 are shown in table 1.

Table 1. Sources of support in 1996-97

Source	Full-time	Part-time
Total	7,629	13,551
No award or financial backing	3,344	6,308
UK LEA mandatory/discretionary awards	2,095	333
Institutional waiver of support costs	296	426
Local government	8	1
Research councils and British Academy	593	18
Charities and international agencies	60	39
Governmental authorities	440	1,152
EU Commission	65	103
Other overseas sources	63	13
UK industry and commerce	202	3,867
Absent/no fees	29	176
Unknown	434	1,115

SOURCE: Higher Education Statistical Agency (1998).

The research councils are public bodies funded by the government. The roles of the three principal public funding bodies before 1993 are explained below.

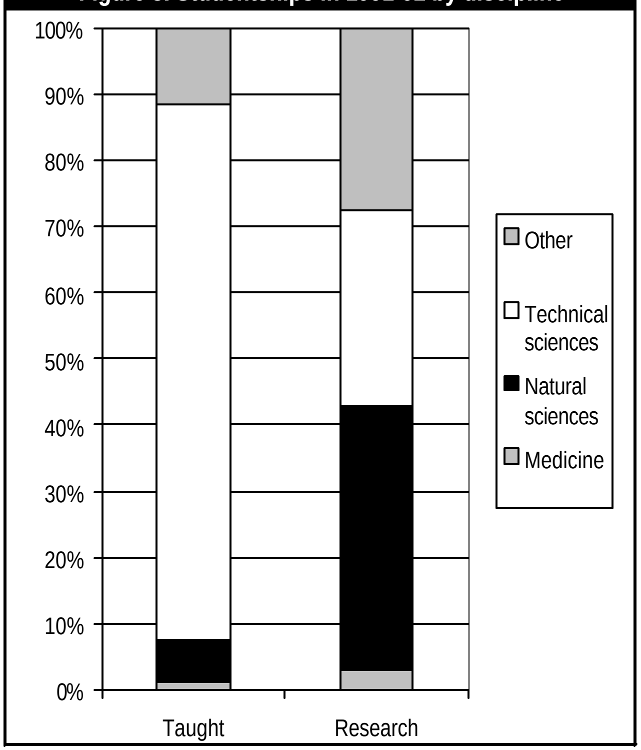
- **Economic and Social Research Council (ESRC).** The ESRC makes available approximately 300 research awards for full-time graduate research training (M.Phil. or Ph.D.) in the social sciences at recognized institutions. The council makes a distinction between so-called "Mode A" and "Mode B" departments. Mode A departments have demonstrated that they can provide formal training in research methods and techniques in the first or foundation year of the program, according to ESRC guidelines. They accept ESRC-funded students without previous graduate research training for full 3-year awards. Mode B departments can only take ESRC-funded students with a foundation in research training; usually, these students have completed a master's program that teaches research methods.

- **Science and Engineering Research Council (SERC).** The SERC awards approximately 2,355 research studentships each year. There are two types of awards: standard awards and the Cooperative Awards in Science and Engineering (CASE). Standard awards are allocated by the SERC as quotas to departments in institutions, which nominate eligible candidates. A small number are awarded to individuals on a competitive basis. The cooperative awards give students experience in research in an industrial environment.

- **British Academy.** Before 1992, the British Academy gave approximately 500 major studentships each year through its national awards competition. The majority of these provided 3 years of funding for research students in the humanities. Since 1992, the total number of awards as well as the number of 3-year awards have increased. Of the 400 3-year awards offered each year, 100 would be available to students without postgraduate experience and 300 would be restricted to students with 1 year's postgraduate research training.

Other research councils are the Medical Council and the Natural Environment Research Council. The research councils' studentships vary across disciplines. Figure 8 shows the number of studentships in 1991-92 by discipline.

Figure 8. Studentships in 1991-92 by discipline



SOURCE: Office for Science and Technology (OST). Annual Review of Postgraduate Awards 1992/1993. Unpublished.

Although the ESRC started to fund part-time students through a national competition, most part-time graduate students finance their own studies or are financed by their employers. The latter source of support is more common for taught master's degrees than for research master's or Ph.D.s because of the link between master's degrees and employment. Some universities provide their own studentships, which are mainly awarded to students who have been unsuccessful in the research councils' or British Academy's competitions. A studentship generally involves a maintenance award (equivalent to a research council or British Academy grant), together with payment of fees (Burgess et al. 1995). Furthermore, universities employ graduate students as class teachers or have developed teaching assistant programs.

Following the publication of the government white paper *Realising Our Potential* in May 1993, the research councils' system of funding has changed. There are now six research councils, five that provide funding for sciences and technology, and one funding the economic and social sciences:

- Biotechnology and Biological Sciences Research Council,
- Engineering and Physical Sciences Research Council,
- Medical Research Council,
- Natural Environment Research Council,
- Particle Physics and Astronomy Research Council, and
- Economic and Social Research Council.

In addition, the British Academy looks after the humanities.

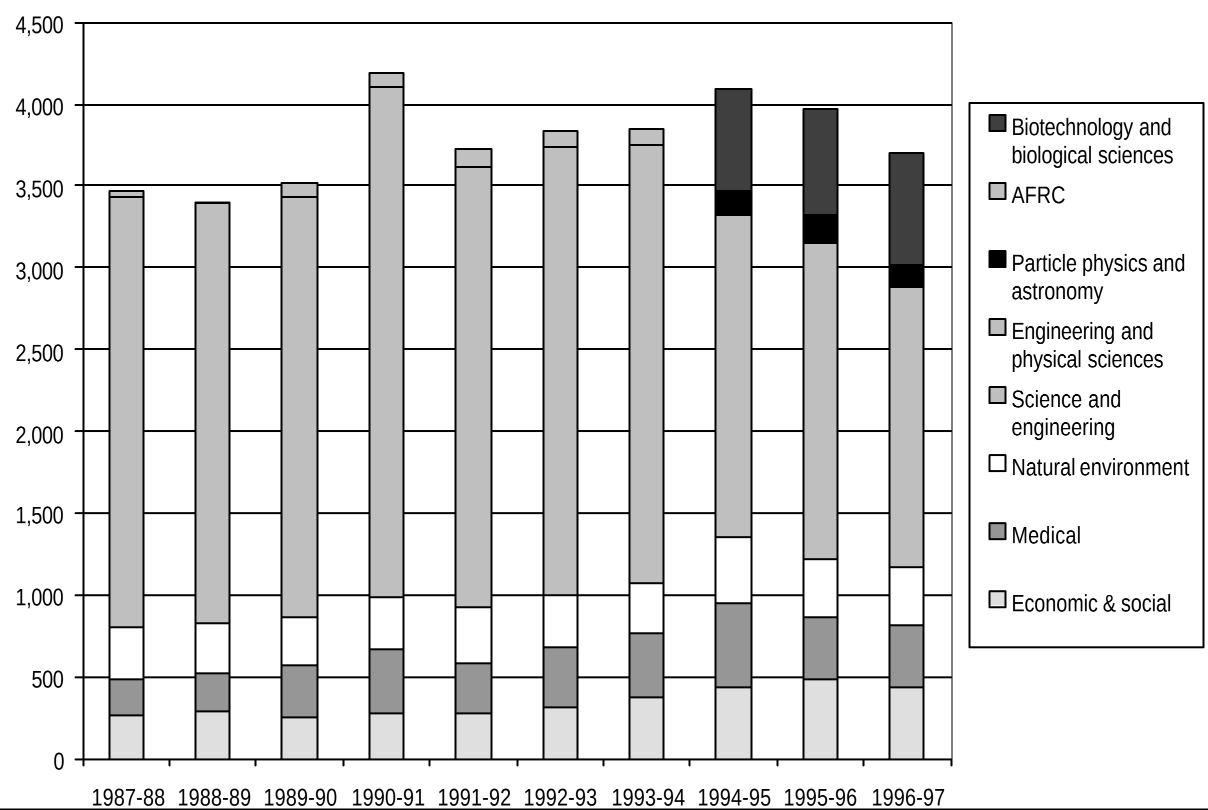
The six councils are government agencies reporting to the Office of Science and Technology; they grant funding for individual postgraduates. The competition for research funding is intense, with only a small percentage of candidates making successful applications. There are three types of funding given by the research councils (CSU 1998): advanced course studentships, which are master's level taught courses; research master's training awards; and standard research studentships, which are for Ph.D. or M.Phil. students for programs of up to 3 years full time or 5 years part time. Some of the research councils give CASEs, which are similar to standard research studentships but involve cooperation with a partner in industry. The research councils set their own level of payment, but all awards for British students include tuition fees (a payment straight to the institutions); a maintenance grant; and a contribution toward travel, fieldwork, materials, and other expenses.

To qualify for a full award, candidates should be resident in the United Kingdom and possess a first-class or an upper second-class degree (a lower second-class degree is the minimum requirement for an advanced course studentship from the Natural Environment Research Council or Engineering and Physical Sciences Research Council). Each council regularly reviews academic departments and programs, and allocates advanced course studentships through a quota system to the departments of the approved programs. The departments can select the candidates they believe to be most qualified. Figure 9 shows the number of research council studentships from 1987-88 until 1996-97.

EMPLOYMENT PATTERNS

For most of those who start a graduate program, an academic career remains the central objective (Becher, Henkel, and Kogan 1994). The strength of this aspiration, however, varies by discipline. In the humanities and social sciences, academic careers are the prime goal of those who register for doctorates. Although this goal is also strong in the natural sciences and technology, the aspiration level in these disciplines is lower when there are good employment possibilities in commercial or other nonacademic activities. Especially in many branches of chemistry and biochemistry, doctoral training is considered applicable to both theoretical and applied areas. Various studies of the employment of social science Ph.D.s show that employers generally do not consider a doctorate to be a significant advantage (Pearson et al. 1991). Employment trends for people with a Ph.D. degree in the social sciences indicate that higher education is the major employer. A larger proportion of those holding a taught master's than of Ph.D. recipients go into industry and commerce or the public sector; a smaller proportion enters academic life (table 2).

Figure 9. Number of research studentships awarded by the research councils



SOURCE: Office for Science and Technology (OST). Annual Review of Postgraduate Awards. Unpublished.

Destination	Ph.D.		Master's	
	1989	1992	1989	1992
Permanent academic appointment	4.2	3.6	2.0	2.0
Fixed term academic appointment	23.1	22.5	5.0	4.0
Further training	1.6	2.6	9.5	9.0
(School) - teacher training	1.0	1.1	0.8	1.0
Private sector (industry or commerce)	22.7	17.7	35.7	29.0
Government or other public sector	5.5	6.1	9.5	9.0
Other employment	1.8	1.8	1.0	2.0
Not employed	7.0	8.6	3.0	3.0
Unknown	22.6	25.4	28.5	38.0
Overseas	10.6	10.6	4.0	3.0

Table 2. First employment destinations of Ph.D. and Master's degree recipients, 1989 and 1992 (percentages)

SOURCE: Office for Science and Technology (OST). Annual Review of Postgraduate Awards. Unpublished.

The first destinations of U.K. resident postgraduates in 1996-97 are shown in table 3.

One of the primary purposes of the Ph.D. is still considered to be the preparation of the future generation of academics. The limited number of vacancies available, however, largely frustrates this aim. At the same time, outside the research context, the Ph.D. does not appear to enhance job prospects. Employers are likely to be more impressed with the promise of all-around capability of a master's degree-holder than with the more narrowly focused competency associated with doctoral qualifications.

For the most part, research education is a risky investment. On the one hand, the advantage of a Ph.D. compared to undergraduate degrees is absent in a whole range of nonacademic occupations. On the other hand, only a minority of Ph.D.s are given the opportunity to secure their most preferred employment. The policies proposed in the 1993 white paper could reduce some of these uncertainties. The taught master's program can function as a selection mechanism through which all potential doctoral students should pass. The resulting fewer entrants will in this way find less competition for academic posts. In fact, their employment possibilities will be even better, since more academic posts will become available due to a large outflow of retired academics. By increasing the number of master's degrees and reducing the number of Ph.D.s in areas where there is a surplus of Ph.D.s as compared with academic labor market requirements, the connection with the labor market should be recovered.

Table 3. First employment destinations of U.K. resident postgraduates, 1996-97

Destination	Doctorate degree	Other postgraduates
Entered work	3,356	8,258
Returned to/remained with previous employer	573	1,802
Self-employed	83	450
Entered study or training	163	2,022
Seeking employment or training	97	687
Not available for employment/studies/training	83	350
Percentage with known destinations	77.5	73.2

SOURCE: Higher Education Statistical Agency (1998a).

Patterns of International Mobility

In 1991, over 46 percent of the graduate students in British institutions were from overseas. The large increase in overseas full-time graduate students, both in absolute numbers and in comparison with U.K. students, is shown in table 4.

In the 1990s, the relative number of all overseas full-time postgraduate students decreased. British postgraduate education, however, remained an attractive destination for European Union (EU) students. In 1994, 9 percent of full-time postgraduate students were from non-British EU countries (figure 10). This was mainly because students from EU countries were eligible for tuition fees

Table 4. Numbers of U.K. and overseas students from 1981-82 to 1990-91

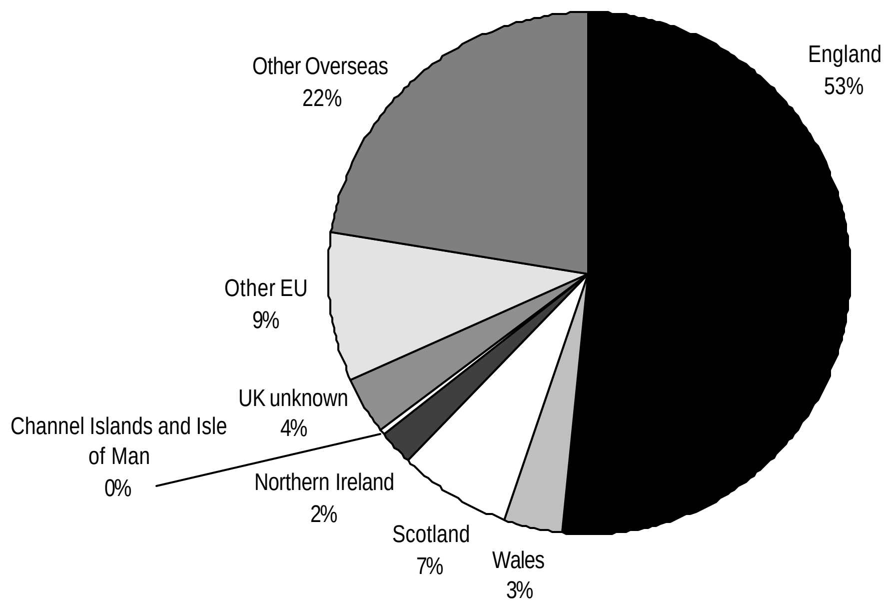
Year	Total students in postgraduate program	Number of U.K. students	Number of overseas students	Overseas students as percentage of total
1981-82	34,276	20,941	13,335	38.9
1982-83	33,903	20,610	13,293	39.2
1983-84	35,928	21,582	14,346	39.9
1984-85	37,563	22,377	15,186	40.4
1985-86	40,498	23,384	17,114	42.3
1986-87	42,824	24,144	18,680	43.6
1987-88	43,733	23,465	19,268	44.1
1988-89	44,175	23,899	20,276	45.9
1989-90	45,644	24,247	21,397	46.9
1990-91	49,950	26,537	23,413	46.9

SOURCE: Office for Science and Technology (OST). Annual Review of Postgraduate Awards. Unpublished.

at U.K. rates. In four subject areas, overseas students even outnumbered British students: veterinary science, agriculture and related studies, business and financial studies, and engineering and technology.

The internationalization of graduate education in the United Kingdom has raised several policy questions. Some programs are fashioned deliberately to meet the needs of overseas students. In some cases, it is expected that programs would not even be viable without overseas students. Because departments gain no financial advantage from overseas students—and, in some cases, might even lose money offering these programs—a ceiling may be placed on EU admissions.

Figure 10. Domicile of postgraduate students in U.K. institutions, 1994



SOURCE: Higher Education Statistical Agency (1998c).

ACKNOWLEDGMENTS

The authors wish to thank Petra Boezerooy, Frans Kaiser, and Anne Klemperer from the Center for Higher Education Policy Studies Higher Education Monitor Unit for the statistical information provided.

References

Advisory Board of the Research Councils (ABRC). 1982. *Report of the Working Party on Postgraduate Education (Swinnerton-Dyer Report)*. London.

Becher, T. 1993. Graduate Education in Britain: View From the Ground. In B.R. Clark, ed., *The Research Foundations of Graduate Education*. Los Angeles: University of California Press.

Becher, T., M. Henkel, and M. Kogan. 1994. *Graduate Education in Britain*. Higher Education Policy Series 17. London: Jessica Kingsley Publishers Ltd.

Blume, S. 1995. Problems and Prospects of Research Training in the 1980s. In Organisation for Economic Co-operation and Development, ed., *Research Training, Present and Future*. Paris.

Brennan, J., and T. Shah. 1994. Higher Education Policy in the United Kingdom. In L. Goedegebuure et al., eds., *Higher Education Policy: An International Comparative Perspective*. Oxford: Pergamon Press.

Burgess, R.G., S. Band, and C.J. Pole. 1998. Developments in Postgraduate Education and Training in the UK. *European Journal of Education* 33(2): 145-59.

Burgess, R.G., J.V. Hogan, C.J. Pole, and L. Sanders. 1995. Postgraduate Research Training in the United Kingdom. In Organisation for Economic Co-operation and Development, ed., *Research Training, Present and Future*. Paris.

Clark, B.R. 1995. *Places of Inquiry: Research and Advanced Education in Modern Universities*. London: University of California Press.

CSU (Higher Education Careers Services Unit). 1998. <<http://www.prospects.csu.man.ac.uk/pd/index.htm>>.

Committee on Higher Education. 1963. *Robbins Report*. London.

Committee of Vice-Chancellors and Principals. 1988. *The British Ph.D.* London.

HEFCE, CVCP, and SCOP. 1996. *Review of Postgraduate Education (The Harris Report)*. Bristol: HEFCE.

Higher Education Statistics Agency. 1998a. *Students in Higher Education Institutions, 1996/97*. Cheltenham, UK.

———. 1998b. *First Destination of Students Leaving Higher Education Institutions, 1996/97*., Cheltenham, UK.

———. 1998c. <<http://www.hesa.ac.uk/holisdocs>>.

Ince, M. 1992. Science Mandarins Back Elite Schools. *Times Higher Education Supplement* February 28.

Kaiser, F., J. Hezemans, and H. Vossensteyn. 1994. *Doctorate Education: A Comparative Description of the Systems Preparing for the Highest Academic Degree in Seven Western Countries*. Enschede: Center for Higher Education Policy Studies.

National Committee of Inquiry Into Higher Education. 1997. *Higher Education in the Learning Society (Dearing Report)*. Norwich: NCIHE/HMSO.

Office of Science and Technology (OST). 1993a. Annual Review of Postgraduate Awards 1992/1993. Unpublished.

———. 1993b. *Realising Our Potential: A Strategy for Science Engineering and Technology*. Government White Paper. London: HMSO.

Office of Science and Technology, Science and Technology Committee. 1995. *First Report Technology Foresight, Vol. 1.* Report and Minutes of Proceedings, November 29. London: HMSO.

———. 1995. *First Report Technology Foresight, Vol. 1*. Science and Technology Committee. Report and minutes of proceedings, November 29, 1995. London.

Pearson, R. I. Seccombe, G. Pike, S. Holly, and H. Connor. 1991. *Doctoral Social Scientists in the Labour Market*. IMS Report No. 217. Brighton: IMS.

Simpson, R. 1983. *How the Ph.D. Came to Britain: A Century of Struggle for Postgraduate Education*. Guildford, UK: Society for Research Into Higher Education.