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ABSTRACT

The countries discussed in this report are mainly Western European and are those from which modern science, analytical methods, and inductive and deductive reasoning arose in the 17th and 18th centuries. This report has been prepared to provide as consistent a database as possible on human resources for science in the specified European countries. In addition to data on population, education, and science and technology personnel, 17-year time series are included on gross domestic product and research and development expenditures. These data also provide the basis for key indicators of future growth and demand for scientists and engineers. A concluding section of the report discusses prospects for the future based on trends in the growth and integration of European science and technology. The data are displayed using numerous charts, graphs, and appendices. Contains 113 references. (DDR)

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Foreword

The adequacy of future human resources for science and engineering is an important issue for the United States. In 1993, the Division of Science Resources Studies (SRS) published an initial report on *Human Resources for Science and Technology: The Asian Region.* This current report is designed to further the understanding of global science and technology resources by providing a reliable database and analysis for the European region, which has a high concentration of the world's scientific resources. This report was prepared to provide information for U.S. decisionmakers in their assessments of trends in globalization, particularly on human resources. Many national and international organizations are interested in this topic. For example, the Organisation for Economic Co-operation and Development, the Commission of the European Communities, and the International Council of Scientific Unions have been active in discussing these topics.

This report complements and supplements the National Science Board's *Science and Engineering Indicators* volumes and several other reports prepared by the Division of Science Resources Studies.

Jeanne E. Griffth, Director
Division of Science Resources Studies
Directorate for Social, Behavioral,
and Economic Sciences

November, 1996

NOTE

U.S. R&D data presented in this report are based on statistics published in NSF/SRS
National Patterns of R&D Resources: 1994
For updated U.S. data, see
National Patterns of R&D Resources: 1996

Acknowledgments

This report was prepared by Jean M. Johnson, Senior Science Resources Analyst, Science and Engineering Indicators (IND) Program, Division of Science Resources Studies (SRS), National Science Foundation.

The database developed to prepare this report builds on data provided by the Division of Statistics of the United Nations Educational, Scientific, and Cultural Organisation (UNESCO) and the Center for Educational Research and Innovation (CERI) of the Organisation for Economic Co-operation and Development (OECD). Through an annual survey sent to more than 150 countries, UNESCO gathers worldwide data on higher education, research, and other dimensions of development, which it has generously provided to NSF. The report utilizes the research and development data from the OECD *Main Science and Technology Indicators.*

To verify and update the UNESCO and OECD degree data, NSF was fortunate in receiving full cooperation from individuals in Ministries of Education and in science and technology indicator groups in each of the European countries studied in this report. In addition to their other contributions, these individuals have provided their national primary sources on higher education so that NSF could develop a reliable data base on human resources for science and technology. Their names, affiliations and addresses are listed in the Contacts section of the report. This voluntary exchange of information is very encouraging and will assist SRS in completing other regional profiles.

Jennifer Sue Bond, Director of the Science and Engineering Indicators Program within SRS, supported the continuation of this research on human resources within the Division, suggested contacts in each of the European countries, and provided relevant OECD and national publications. William Blanpied, of the Division of International Programs, read an early draft and provided many useful suggestions and additional information on institutions of higher education.

The report also benefited from the comments provided by other colleagues in the Division of International Programs, and several external peer reviewers, including E. Stephen Hunt of the U.S. Department of Education, Philip W. Hemily of the National Research Council, Philip Altbach of the University of Boston, Peter Syverson of the Council of Graduate Schools, Richard A. Ellis of the American Association of Engineering Societies, Erika Rost of the Federal Ministry for Education, Science, Research and Technology in Germany, Kirsten Wille Maus of the Norwegian Institute for Studies in Research and Higher Education, Serge Plattard, Science Counselor of the French Embassy, Helen Connor of the University of Sussex, Lennart Stenberg of the Swedish National Board for Industrial and Technical Development, and Ian R. Perry of the Commission of the European Communities. Overall guidance and review were provided by Jennifer Sue Bond and Kenneth M. Brown. Editing of the report was performed by Friday Systems Services.

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Acronyms

CERN	European Center for Nuclear Research
EC	European Community
EFTA	European Free Trade Agreement
ESRF	European Synchrotron Radiation Facility
EU	European Union
FTE	Full-time equivalent
GDP	Gross domestic product
LHC	Large Hadron Collider
NS&E	Natural science and engineering
NSF	National Science Foundation
OECD	Organisation for Economic Co-operation and Development
PPP$	Purchasing power parity dollars
R&D	Research and development
RSE	Research scientist and engineer
S&E	Science and engineering
S&T	Science and technology
UNESCO	United Nations Educational, Scientific, and Cultural Organization

Overview

During the past decade, several European countries invested heavily in research and development (R&D), including building world class laboratories and other facilities and greatly expanding higher education in science and engineering. These accomplishments are an important part of, and the underpinnings for, a broader effort to maintain and enhance the economic vitality of Europe through the European Union (EU). The goal of the EU is to strengthen Europe by enhancing economic and social prosperity, while preserving cultural diversity (Delors, 1994). The EU (see sidebar for countries included) is attempting to integrate the science and engineering (S&E) research community and make the region's high concentration of science resources even more productive by encouraging greater cooperation and collaboration across borders. The R&D policy of the EU is to strengthen the S&T basis of European industry in order to increase competitiveness at the European level and the global level. A series of Framework Programs that fund pre-competitive research in strategic areas, some of which are congruent with U.S. national science policy and research interests, has been the major effort for achieving this policy. In addition, national programs and other multinational endeavors independent of the EU are expanding S&E education, strengthening doctoral programs, and enhancing R&D collaboration across Europe.

The countries covered in this report, mainly Western European, are those from which modern science, analytical methods, and inductive and deductive reasoning arose in the 17th and 18th centuries. These conceptual innovations and the model of a research university were transferred to other world regions. Europe's S&T contributions, from centuries of discoveries and long traditions of university education and doctoral research training, cannot be fully described by examining the past 17 years of data. However, data on those countries presented in this report, describing growth in academic degrees, R&D, and gross domestic product (GDP) indicate that a high concentration of the world's scientific resources continue to reside in the European region.

The increase in the awarding of natural science and engineering (NS&E) degrees by institutions in Western and Central European countries is particularly noteworthy. First university-level degrees in NS&E fields reached almost 300,000 in 1992, compared with 173,000 awarded in the United States. In that same year, doctoral degrees awarded in these fields in Europe numbered more than 25,000, compared with approximately 17,000 degrees awarded in the United States. Western European countries invested $103.5 billion[1] in overall R&D in 1993 compared with the $137.3 billion in the United States in that year. However, civilian research in Western Europe approaches that of the United States. In 1992, the non-defense R&D expenditures of Western European countries reached $95.8 billion; that of the United States reached $104.7. The combined GDP of Western European countries surpassed that of the United States in the late 1980s.

Implications for the United States

The current levels and projected growth of financial and human resources devoted to S&T in Europe pose some emerging issues that will be important in S&T policy discussions in the United States. One such issue relates to identifying opportunities from improved integration of European resources with U.S. resources, both through traditional scientist-to-scientist cooperation, as well as more substantial collaboration and cost-sharing. That

[1] All dollar amounts in this report are in 1987 constant purchasing power parity dollars (PPP$). PPPs are used to convert a country's national currency expenditures to a common currency unit that allows *real* international quantity comparisons to be made. PPPs are based on "market basket" pricing exercises. See Notes on Data Series, for details on why PPP$ conversions are preferable to official exchange rates.

The European Union, begun in 1958 with a nucleus of six Western European countries (Belgium, France, Germany, the Netherlands, Italy, and Luxembourg) is a political and economic grouping of countries that are developing a common market and, eventually, a common currency.[2] Six more countries (the United Kingdom, Denmark, Spain, Portugal, Greece, and Ireland) became part of the European Union in the 1980s. Three more countries were added (Sweden, Austria, and Finland) in 1995. Leaders from 21 European countries were invited to the conclusion of the December 1994 Summit meeting on the European Union's future. There is no fixed entry timetable for extension into Central and Eastern Europe. Turkey, Poland, and Hungary have made formal applications for membership.

[2] The Maastricht Treaty of 1992

issue revolves around how the United States could benefit both intellectually and financially from enhanced cooperation with Europeans in research, educational exchanges and in science assistance to developing countries. Another issue, closely related to the first, is how scientific and technological information flows among countries can be improved and expanded.

Implications for Research

The total R&D performed by the European and Asian regions (each approximately $100 billion) far exceeds the amount of R&D performed within the United States. As the capacity to perform research has expanded throughout the world, a decreasing fraction of new knowledge is found in U.S. laboratories, and an increasing fraction of new knowledge originates in other countries. European scientists in particular are conducting sophisticated basic research, and have increasingly sophisticated facilities. Some European countries are approaching 3 percent of their GDP devoted to R&D. This suggests that issues concerning research cooperation for enhancing the advancement of basic knowledge and quickening the pace of scientific discovery, as well as ways for improving information about the scientific and technological accomplishments of other world regions, could grow in importance in the near future.

Current U.S. science policy fosters international cost sharing and promoting access to the world's best science and technology. Europe, with its high concentration of science resources, well-trained PhDs, large facilities and impressive science budgets in non-defense R&D, provides the United States a primary region with which to vigorously pursue this policy. Several currently productive collaborations attest to the array of opportunities; expanding collaboration, however, requires improved science information flows.

U.S. scientists already collaborate in "big science" projects and in large international research programs. For example, the U.S. physicists who work in user groups at large European facilities such as the European Center for Nuclear Research (known by its French initials, CERN), with support from U.S. Government agencies, contribute both their knowledge and experience and financial resources to requisite instruments. Further opportunities are being explored for cooperative arrangements in using European state-of-the-art facilities and contributing to their development, such as CERN's proposed Large Hadron Collider (LHC)[3] and the European Synchrotron Research Facility. U.S. scientists are also active in international research efforts, such as the Human Genome Project and the Global Change and oceanographic science programs.

In addition, university scientists in the United States and Europe have traditionally cooperated with each other. Over a dozen Science and Technology Centers in the United States have collaborative research and formal research agreements with centers of excellence in Europe. For example, at the Center for Research on Parallel Computation, collaboration between the California Institute of Technology and the *Aerodynamisches Institute* in Aachen, Germany, is quickening the pace of new and important results in parallel computing. The Center for Ultrafast Optical Science at the University of Michigan strengthens its research through collaboration with several French scientists from national laboratories, *the Commissariat L'Energie Atomique, Laboratoire pour l'utilisation des Lasers Intenses* at the *Ecole Polytechnique*, and the *Institut d'Optique* in Orsay.

[3] For example, U.S. collaboration in CERN's plan to build the LHC could reduce the delays caused by the severe cuts in its budget (Curien, 1995).

Beyond these opportunities for big science and large programs, however, new issues are likely to arise concerning the best ways to enhance awareness and intensify U.S. involvement and cooperation with scientists and engineers in other excellent facilities in Europe. For example, how might information flows be improved for the U.S. science community to identify promising candidates for further cooperation that would benefit both parties? There are two kinds of information involved: that directly from research laboratories (new discoveries and technologies), and that coming from science organizations (European science initiatives and changes in funding priorities). This raises the issue of to what degree practicing scientists have to be involved in science organizations to identify areas open to cooperation with the United States.

Besides identifying how alternative directions in European research may complement our own, and quicken the pace of, new discoveries, the issue of improving information about both the European and the U.S. science system is likely to grow in importance on both sides of the Atlantic. The historic character and structure of administering R&D in Europe are different from, and complementary to, that of the United States. Many European scientists and engineers work in stable national laboratories, in which sustained funding is not highly dependent on competitive grant proposals. U.S. scientists and engineers work mainly through competitive grant proposals where a competition of ideas often leads to key changes among research foci. While U.S. scientists can initiate a new research area quickly, they often do not have the stable "national laboratory type" environment which may promote long-term continuity. Both systems have different strengths related to continuity and change. New issues implied by these different research systems are how to best utilize the strengths of both systems in concert for the more rapid advancement of new knowledge and for the more timely resolution of problem areas such as global health and environmental concerns.

Implications for Science and Engineering Education

What kind of graduate student exchanges are common in Europe? There is considerable interaction between the U.S. and European research communities, often the result of student exchanges or post-doctoral training positions from decades ago. For example, many older U.S. scientists studied German in college because continuing graduate education in science or engineering often required studies in Europe. As U.S. research universities grew more prominent in the last few decades, American graduate students pursued their advanced degrees at home. But the dearth of U.S. doctoral and post-doctoral S&E students working in European laboratories tends to diminish the prospects for their pursuing collaborative arrangements as working scientists and engineers throughout their careers.

The number of European graduate students studying in the United States has become increasingly modest in recent years, compared, for example, with the number of students from Asia. Students from Western and Central European countries combined received 658 doctoral degrees in science and engineering from U.S. universities in 1992. The numbers of foreign doctoral recipients from European countries is very low compared to other regions. That same year, students from China earned over 1,900 doctoral degrees in science and engineering at U.S. universities.

Europe is, however, preparing NS&E students for international careers through European exchange programs such as ERASMUS, its successor programs, SOCRATES, and the new Framework Program on Training and Mobility of Researchers, aimed at post-graduate students. These programs are based on the assumption that an enabling phase for cooperative research or international careers is best achieved by earlier contact through educational exchanges. Programs such as ERASMUS reflect a cultural change in Europe in which foreign experience is not only seen as desirable but imperative. In many cases graduate students are expected to spend substantial time in another EU country as part of their training.

As science and engineering become more global in nature, international experience will become more important for new generations of scientists and engineers. The consideration of expanded international exchanges for U.S. science and engineering education raises issues of the feasibility of large numbers of American students and

post-docs being received in European universities and research laboratories, as well as whether student exchanges would be impediments or enhancements to completion of currently extensive program requirements. This issue may be better understood through assessment of the costs and benefits from current U.S. science and engineering programs that include a period of study in Europe and Asia.

The United States is undergoing systemic reform to improve all levels of education, particularly to strengthen math and science education in secondary schools. Part of this systemic reform is examining the poor qualifications of secondary math and science teachers. The large majority of U.S. high school science and mathematics teachers do not have a college major or minor in the science they are teaching. A large percentage of European first university degree holders in natural science and engineering go into secondary teaching. This raises an issue regarding how new systemic reforms in the U.S. system might best learn from the European experience.

Implications for Science Assistance Programs

The proportion of foreign students from particular regions will affect the focus of major European countries in training scientists and engineers and in building S&E infrastructure in developing countries. Several European countries are building scientific centers of excellence in North Africa, Eastern Europe, Latin America and Pacific Rim countries, thereby establishing scientific ties as well as commercial ties. Based on their training of foreign students, it would appear that France is intensifying its scientific cooperation with Africa, and Germany with Eastern Europe. For example, French scientists are assisting the *Association Ifriqya* to establish institutes of molecular biology in Africa. The first center of excellence will be for genetic research in Tunisia, the Institute for Genome Research for Developing Countries (IGRDC), to complete the map of the genome of one of the parasites that causes malaria. (Nowak,1994). Past trends would indicate that the United Kingdom will also be expected to further educational and commercial interactions with her former colonies in the Pacific Rim as well as increasing interaction with the EU countries.

Capacity-building in science and education is a current approach to international assistance. One issue regarding U.S. international assistance for such capacity-building in developing countries in Asia, Africa, and Latin America is how best to take into account the science and equipment assistance being received from Germany, France and the United Kingdom to enhance complementary and to most effectively leverage typically modest program funds.

Research Approach

Differences in economic growth among countries are leading to shifts in R&D capabilities among major regions of the world. In particular, the integration of the regional economies of Western Europe and the Pacific Rim is facilitating growth rates in their civilian research programs superior to the growth rate for U.S. civilian research programs (NAS, 1990). Between 1981 and 1992, civilian R&D in Europe grew at an annual rate of 4.9 percent. Non-defense R&D in the United States in that same period grew 4.2 percent annually. Civilian R&D expenditures grew more than 7 percent annually in some Asian countries[4] in this same time period.

This report examines R&D resources of selected European countries, particularly in their human resources. (A previous volume in this series has examined recent trends among selected countries of the Asian Region). Data series were available for 16 European countries, those of the EU and the European Free Trade Association (EFTA), with some limited data for six Central and Eastern European countries. Because of data limitations, the trend data presented on human resources, R&D investments, and GDP growth are for Western European countries only. European trends are compared with trends in the United States to illustrate potential similarities and differences in the area of human S&E resources. However, the human resources section contains S&E degree data for 1 year (1992) for some Central and Eastern European countries in order to approach a measure of the overall level of S&E degrees in Europe.

[4] Among six Asian countries studied, only Japan and India publish defense and non-defense R&D expenditures. China, Taiwan, South Korea, and Singapore do not publish defense expenditures.

It should be noted that this report uses a narrower definition of social science degrees than many Nordic and Germanic European countries. In this report, social sciences include social and behavioral sciences, but do not include humanities.[5]

This report has been prepared to provide as consistent a database as possible on human resources for science in the specified European countries. In addition to data on population, education, and S&T personnel, 17-year time series also are included on GDP and R&D expenditures (both in purchasing power parity dollars). These data also provide the basis for key indicators of future growth and demand for scientists and engineers. A concluding section of the report discusses prospects for the future based on trends in the growth and integration of European science and technology.

Several caveats are in order. First, data are compiled from numerous national and international sources and are not strictly comparable. In addition, degree categories in different countries are not academically equivalent.[6] Finally, some data series do not cover complete periods; therefore, a European regional total on all data is not possible. This is especially true for doctoral degrees in science and engineering. Although these data problems are not trivial, every attempt has been made to develop trends that are approximately equivalent at the broad aggregate level. The degree data were verified on a country by country basis through national education statistics (see References and Contacts). Education statistics for each country were categorized by broad fields of science and, when possible, re-configured to the universally accepted classification scheme, the International Standard Classification of Education.

[5] Most European countries include humanities in their reporting of social science degrees.

[6] This report does not deal with the quality of education in U.S. or European universities or equivalency of degrees across countries.

Regional Summary

This report examines 14 countries of the European Union: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, The Netherlands, Portugal, Spain, Sweden, and the United Kingdom; and two countries of the European Free Trade Association (EFTA): Norway and Switzerland. Limited data on higher education are available for six countries of Central and Eastern Europe: the Czech and Slovak Republics, Hungary, Poland, Bulgaria, and Romania. These 22 countries annually produce approximately 300,000 first university degrees in natural sciences and engineering, considerably more than the United States, but considerably less than the Asian region.[7] (See text table 1.)

[7] Natural sciences include physical, biological, earth, atmospheric, and oceanographic, agricultural, and mathematics and computer sciences. Medical sciences are not included.

Relative to population (Europe has almost twice the population in the college-age group than the United States), however, Central and Western European institutions are not producing more NS&E degrees than those in the United States. In 1992, 4.6 percent of the college-age cohort in the United States received an NS&E degree, while 4 percent of the European college-age population received such a degree in that same year. (See appendix table 1.) Many European countries' first university degrees, however, are for 6-year programs and therefore may be more comparable with a combined bachelors and masters degree in the United States.

European and Asian universities are generally more focused on natural science and engineering (NS&E) fields than universities in the United States. About 30 percent of total first university degrees in European Union (EU)

Text table 1. First university degrees in science and engineering, by region: 1992

Field	United States	Europe	Asia
Total first university degrees	1,150,072	1,004,493	1,725,323
Natural sciences and engineering	173,099	299,057	523,651
Natural sciences	111,158	140,126	242,879
Engineering	61,941	158,931	280,772
Social science	182,166	116,353	236,018

NOTES: The requirements for first university degrees in S&E fields are not comparable across, or even within, the countries included in these three regions, particularly for European universities. For example, Germany submits both the university degrees (with an average duration of 7 years) and the Fachhochschulen degrees (polytechnics of 4.5 years average duration) as first university degrees (level 6 in United Nations Educational, Scientific, and Cultural Organization [UNESCO] classification). Work has been underway for several years at UNESCO, EUROSTAT, and the U.S. Department of Education to refine the levels of higher education for better comparability across countries. See for example, *Mapping the World of Education: The Comparative Database System (CDS),* U.S. Department of Education and the National Science Foundation, Washington, D.C., 1994. A new UNESCO survey will be designed and implemented by the end of this decade.

See appendix table 1.

countries are in fields of natural sciences and engineering; about 15 percent of U.S. bachelor's degrees are in these fields. (See figure 1 and appendix table 2.)

In 1992, doctoral degrees awarded in NS&E fields by Western and Central European institutions totaled more than 25,000, 38 percent above the U.S. level, and more than twice as many as Asian countries. (See text table 2 and appendix table 3.) Like the United States, a large percentage of European doctoral degrees are earned by foreign students.

How has this pool of scientists and engineers expanded during the 1970s and 1980s, and what are the prospects for the 1990s? The following section examines the growth in science and engineering (S&E) education from 1975 to 1992 and the significance of the European region in human resources for science. A regional summary of three dimensions—human resources, research and development (R&D) investment, and economic growth—is followed by country-specific details on each dimension. Near-term prospects for Europe's human resources for science and technology are provided in a concluding section.

Human Resources

The concept of the university as a community of scholars dedicated to the advancement and transmission of knowledge emerged in Italy, France, and England in the late Middle Ages and had spread throughout the continent by the beginning of the Modern Era. Bologna, the world's oldest university, was established during the 11th century, followed by Paris and Oxford in the 12th century. By the end of the 13th century, there were 16 universities in Europe: 7 in what is now Italy; 3 in France; and 2 each in Portugal, Spain, and England. By the end of the 15th century, which witnessed both Gutenberg's invention of moveable type and the beginnings of the voyages of discovery and exploration, there was a total of 48 European universities, including nine in what is now Germany; 1 each in Denmark, Poland, Sweden, and Switzerland; and 1 each in what are now Austria and the Czech Republic (OECD, 1992; Academic American Encyclopedia, 1994).

Enrollment in Higher Education

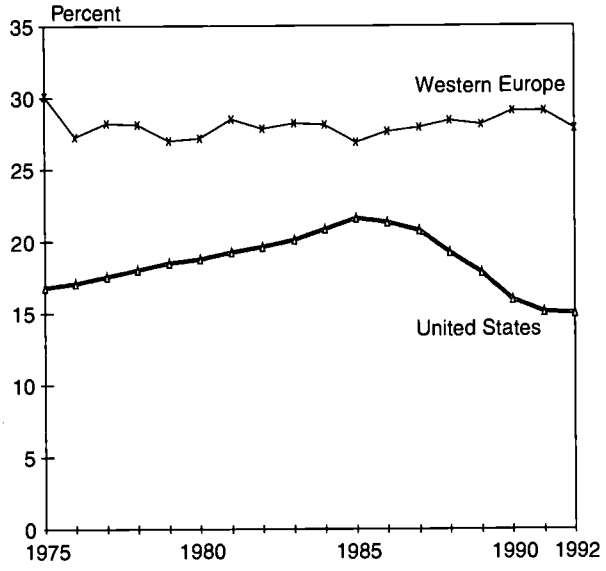
Until recently, university education in Europe was lengthy, research oriented, and reserved for an elite group of scholars who had successfully completed a rigorous academic high school track. In the 1960s, the accelerated pace of economic development created a demand for more skilled labor, and the expansion of the middle class caused a great demand for higher education. Governments in Europe responded to these pressures by forming the so-called non-university tertiary-level institutions, such as the *Instituts Universitaires de Technologie* in France in 1966, polytechnics in the United Kingdom in 1969, and the *Fachhochschulen* in Germany in 1971 (Academia Europaea, 1992). The small number of students in secondary and higher education in these countries began

Text table 2. Doctoral degrees in science and engineering, by region: 1992

Field	United States	Europe	Asia
Total science and engineering	25,184	29,540	11,767
Natural sciences and engineering	18,251	25,310	11,223
Natural sciences	12,555	18,951	6,593
Engineering	5,696	6,359	4,630
Social science	6,933	4,230	544

See appendix table 3.

Figure 1. Proportion of first university degrees in natural sciences and engineering in Western European countries and the United States



See appendix table 2.

to expand to alleviate the serious shortage of trained workers. Similar institutions arose throughout other Western European countries during this period, thus broadening the student base in higher education. In the past 15 years, university education in science and engineering has expanded to create an increasingly highly skilled population. Enrollment in higher education has experienced rapid growth from approximately 7 million students in 1975 to more than 11 million in 1991. (See figure 2 and appendix table 4.)

Education reforms have been promoted to develop and maintain national capabilities in new high technology sectors and to upgrade technologies in other sectors for improved international competitiveness.

In contrast to newly industrializing countries in Asia, where college-age populations are growing (NSF, 1993a), the college-age cohort in North America, Japan, and all industrialized countries in Europe is declining. Even in this situation, the number of science and engineering degrees is increasing. The following section will discuss recent reforms in education to accommodate the increased democratization of higher education throughout Europe.

Detailed time series data have been compiled for Western Europe. Data for 1992 were compiled for some Central and Eastern European countries.

University Degrees in the Natural Sciences and Engineering

Over the 17-year period examined, the Western European countries[8] covered by this report have collectively more than doubled their annual production of first university degrees in natural sciences and engineering. (See figure 3.) The number of natural science degrees increased from approximately 56,000 in 1975 to more than 122,900 in 1992. The number of engineering degrees rose from 53,000 in 1975 to more than 116,600 in 1992. This represents about a 4.5-percent average annual rate of increase in the natural sciences, and an even higher rate of increase for engineering (5 percent). Throughout Europe, during this same time period, university degrees in non-science fields grew even faster than those in science and engineering. For all countries combined, the average annual increase in total university degrees was more than 6 percent.

Trends in S&E degree production in the United States are quite different: the number of U.S. first university degrees awarded in the natural sciences and in engineering remained relatively stable from 1975 to 1983,[9] peaked in 1985–1986, and has since declined steadily in absolute numbers. (See figure 3 and appendix table 5.)

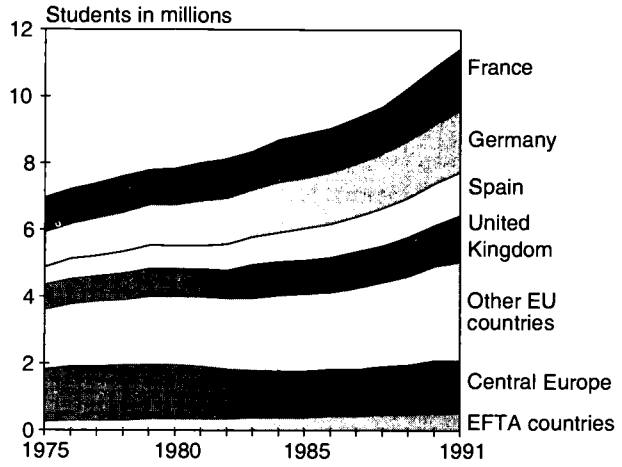
Germany, France, and the United Kingdom account for more than 60 percent of the first university degrees awarded in natural sciences in Europe. (See figure 4.) At the doctoral level, France and Germany account for well over half of the approximately 19,000 degrees in natural sciences in the European region. (See appendix table 3.)

France and Germany are the main producers of first university engineering degrees, accounting for approximately half of total engineering degrees in EU countries. (See figure 5.) The sharp increase in engineering degrees awarded in Germany in 1989 results

[8] EU and EFTA countries.

[9] These stable years came after a rapid increase in the number of engineering degrees in an earlier period.

Figure 2. Growth in enrollment in higher education in selected European countries and regions



EU = European Union; EFTA = European Free Trade Association

See appendix table 4.

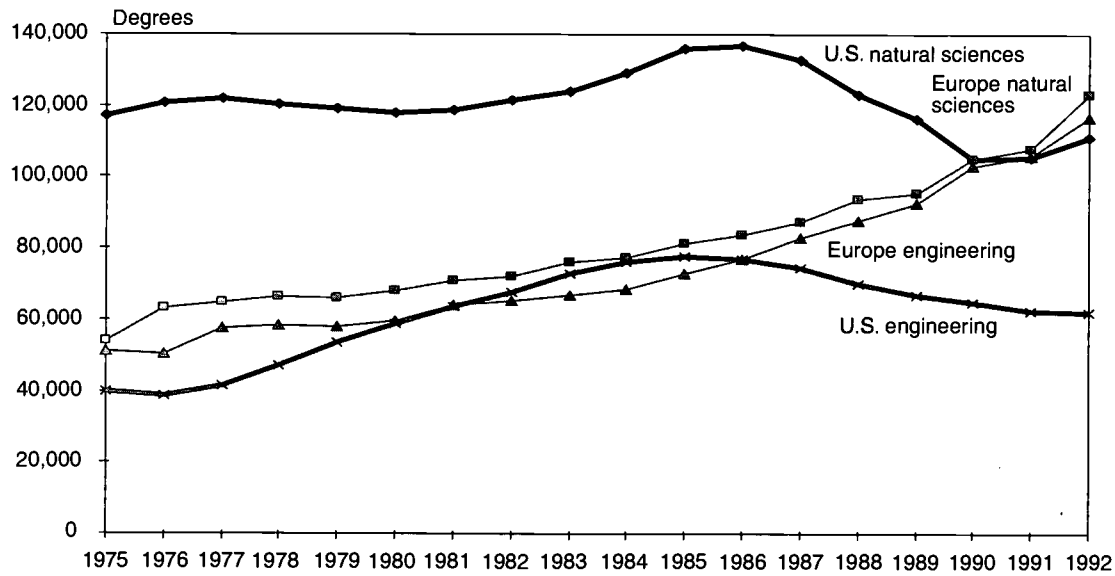
from the unification of former West Germany with former East Germany. The higher-education systems of satellite countries of the former Soviet Union were generally focused on engineering fields. (See appendix table 1.)

The sharp increase in number of natural science and engineering degrees in the United Kingdom in 1992 stems from the inclusion of colleges and polytechnics in university statistics. At the doctoral level, France, Germany, and the United Kingdom produced nearly three-quarters of the European degrees in engineering. (See appendix table 3.)

Demographic Changes

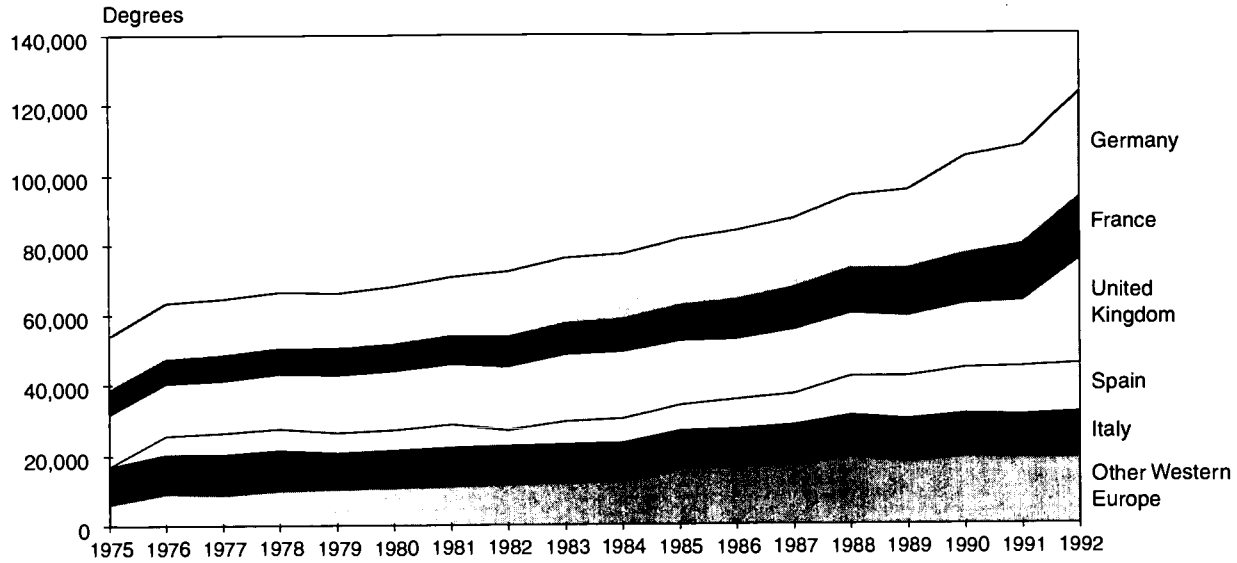
In the 1980s, the college-age population began declining in the highly industrialized countries of Western Europe, the United States, and Japan. In Western Europe, the number in this segment of the population decreased by 3 million between 1990 and 1995 and will continue to decline until 2005. Germany has had a declining 20- to 24-year-old population since 1985; Finland, since 1975.

Figure 3. First university degrees awarded in natural sciences and engineering in Western European countries and the United States



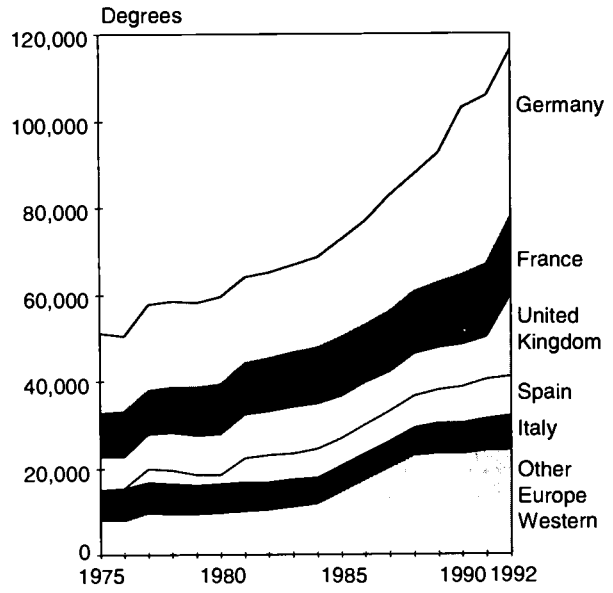
See appendix table 5.

Figure 4. First university degrees in natural sciences in selected European countries



See appendix table 5.

Figure 5. First university degrees in engineering in selected European countries



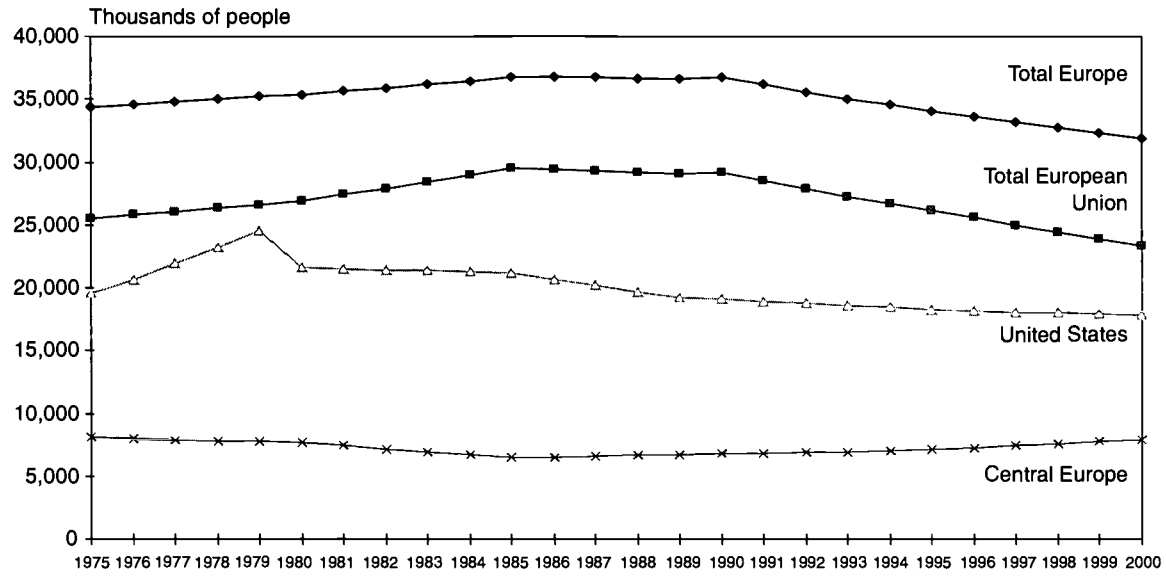
See appendix table 5.

The pool of college-age students in Central European countries declined between 1975 and 1990, but the size of this age segment is slowly increasing in these countries (World Bank, 1993). (See figure 6 and appendix table 6.)

Participation Rates in Natural Science and Engineering Degrees

A declining pool of college-age students in Europe has not resulted in declining numbers of NS&E degrees, as has occurred in the United States. Participation rates in university education in general, and in NS&E degrees in particular, have grown to more than offset the declining population. Participation rates have increased in select European countries. (See figure 7 and appendix tables 7 and 8.) In Finland, more than 6 percent of the college-age cohort obtains a university degree in natural sciences or engineering, similar to the participation rates of Japan and South Korea. The large increase in participation rates in Germany in the past few years reflects the inclusion of East German universities, and their greater focus on engineering degrees. The trend data on S&E degrees for the United Kingdom do not include colleges and polytechnics until 1992, when they achieve university

Figure 6. Number of 20- to 24-year-olds in European countries and the United States: 1975-2000 (projected)



See appendix table 6.

status. (See appendix table 5.) When NS&E degrees from these institutions are included in the 1992 data, U.K. participation rates are more than 5 percent. (See appendix tables 1 and 8.) Spain shows significant gain in awards of NS&E degrees and is now on a par with many EU countries.

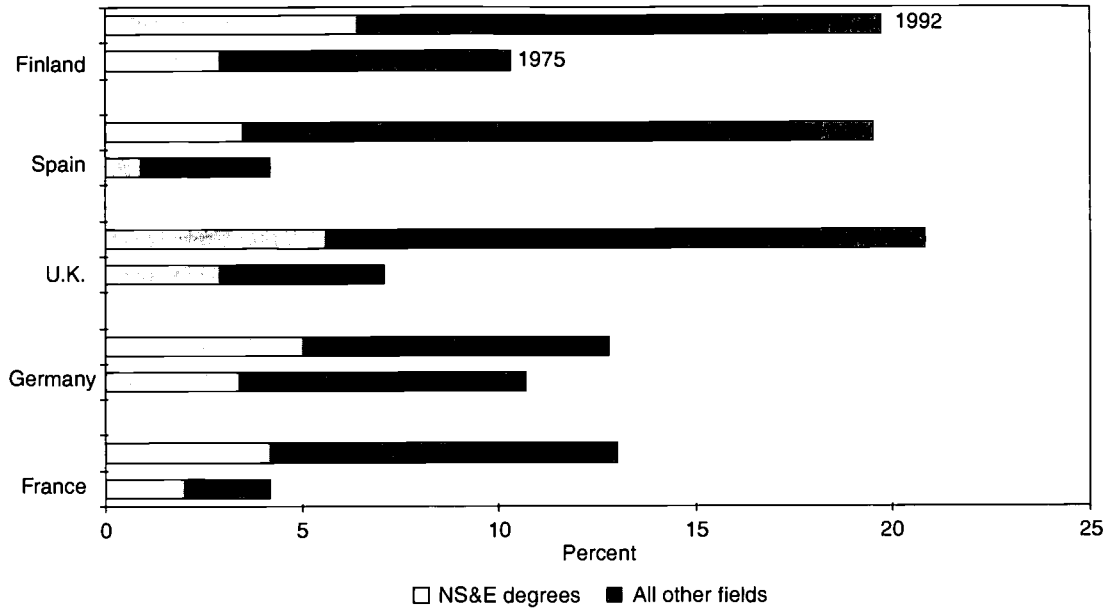
Foreign Students in European Universities

Major centers of learning in Europe have historically been international; half the enrollments at the University of Paris in the 1500s were foreign students. France has traditionally hosted the largest number and percentage of foreign students among European countries (Charlot and Pottier, 1992). Today, France, Germany,[10] and the United Kingdom educate a considerable number of foreign students, representing between 5 and 7 percent of the total enrollment in higher education in these countries in 1990–1991 (UNESCO, 1993). From 1986 to 1991, the percentage of foreign students in higher-education enrollments in France decreased. Although the number of foreign students increased during this period, the proportion of foreign students in higher education dropped from 10 percent to 7 percent because of the dramatic increase in enrollments by French students. (See text table 3.)

France, Germany, and the United Kingdom are currently receiving a greater percentage of their foreign students from EU countries. France still receives a majority of its foreign students from Africa, but also receives a high percentage of students from Germany, Portugal, the United Kingdom, and Spain. Germany receives 40 percent of its foreign students from Europe—still mainly from Eastern Europe—but a growing number are from France, Italy, Spain, and the United Kingdom. The United Kingdom has tripled its number of foreign students from the EU in the past 5 years, reaching 93,000 in 1992. More than one-third of these are mainly from Germany, Ireland, France, and Greece (Gov. of U.K., 1994c). The percentage of U.K. foreign students from the Asian Commonwealth countries has decreased to 41 percent,

[10] Germany counts children of immigrants, who were born in Germany, but are non-citizens (on permanent resident visas), as foreign students. Accordingly, the foreign student count is not the actual flow of students into Germany.

Figure 7. Percentage of 24-year-olds with first university degrees in natural sciences and engineering in selected European countries



See appendix tables 7 and 8.

Text table 3. Foreign student enrollment in higher education in selected European countries: various years

Country	Year	Enrollment in higher education	Foreign students	Percentage of foreign students
United States	1986	12,670,121	349,610	2.8
	1991	14,527,881	419,585	2.9
France	1986	1,289,942	126,762	9.8
	1991	1,840,307	136,963	7.4
Germany	1985	1,550,211	79,354	5.1
	1990	1,933,602	107,075	5.5
United Kingdom	1985	1,032,491	53,694	5.2
	1990	1,258,188	80,183	6.4

NOTES: Enrollment in all levels of higher education. Percentage of foreign student enrollment in graduate levels in science and engineering would be higher.

SOURCE: United Nations Educational, Scientific, and Cultural Organization, *Statistical Yearbook,* UNESCO, Paris, 1994.

Text table 4. Foreign student enrollment in higher education in France, Germany, and the United Kingdom, by region of origin: various years

Country	Year	Total	Africa	North America	United States	South America	Asia	Europe
France	1986	126,762	72,270	5,830	3,398	4,188	21,762	21,427
	1991	136,963	74,964	5,698	3,474	4,543	21,606	29,644
Germany	1985	79,354	4,614	5,272	4,042	2,578	33,041	32,303
	1990	107,075	6,792	5,462	4,207	3,230	46,317	43,072
United Kingdom	1985	53,694	10,248	6,121	4,166	823	25,800	9,814
	1990	80,183	9,283	7,691	5,401	1,425	33,091	27,675
				Percentage				
France	1986	100.0	57.0	4.6	2.7	3.3	17.2	16.9
	1991	100.0	54.7	4.2	2.5	3.3	15.8	21.6
Germany	1985	100.0	5.8	6.6	5.1	3.2	41.6	40.7
	1990	100.0	6.3	5.1	3.9	3.0	43.3	40.2
United Kingdom	1985	100.0	19.1	11.4	7.8	1.5	48.1	18.3
	1990	100.0	11.6	9.6	6.7	1.8	41.3	34.5

NOTES: Includes all levels of higher education. Asia includes Middle East countries in UNESCO regional classification.

SOURCE: United Nations Educational, Scientific, and Cultural Organization, *Statistical Yearbook*, UNESCO, Paris, 1994.

primarily because of the large increase in the number of students from elsewhere in Europe and possibily because of the "full fee" policy for tuition for non-EU students. (See text table 4.)

International Mobility

Most of the EU countries are preparing their scientists and engineers for international work, supporting educational exchanges, working on equivalencies of degrees, and internationalizing their curricula. As a result, a high degree of international student and teacher mobility has occurred. Part of the reason for the increasing flow of students among EU countries is the ERASMUS Program, begun by the European Community in 1987 to fund student and teacher mobility.[11] More than 300,000 students are estimated to have benefited from the ERASMUS Program's Interuniversity Cooperation with 3- to 12-month visits, from 1988 to 1994, representing approximately 7 percent of the undergraduate population in Europe. Thirty percent of ERASMUS student exchanges are in S&E fields. Funding is provided for foreign language training, accommodations, and

[11] ERASMUS built on the experience of the North Atlantic Treaty Organization (NATO) Science Program founded in 1957 to promote international mobility of scientists and engineers. Over the years, approximately 50 percent of the exchanges involved trans-Atlantic cooperation. The EU created the enlarged ERASMUS effort in all fields to promote inter-European mobility.

orientation. Course credits can be transferred back to the home university.

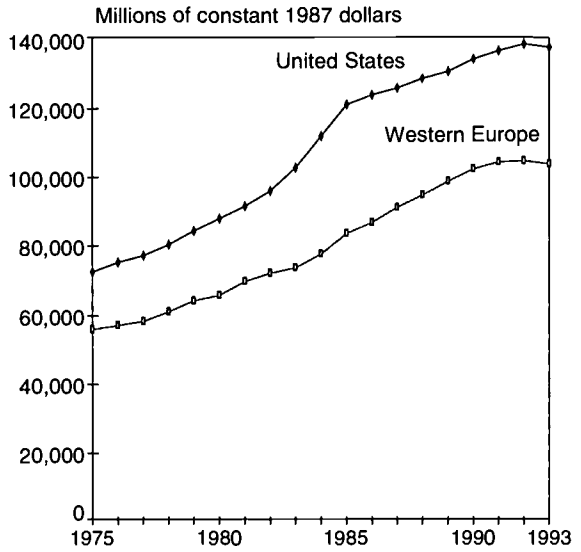
Of even greater impact on European higher education is teacher mobility funded under ERASMUS. An estimated 15,000 professors in higher education have contributed to the regular teaching program at a partner institution, or have jointly developed innovative curricula. The Human Capital and Mobility Program, launched in 1992, has funded 3,500 young researchers (post-graduate and post-doctoral level) to work in laboratories in another country. The EU budget provided around $100 million for ERASMUS in 1993, but the actual cost of implementing student and faculty exchange is far higher and relies on complementary national funding for a country's outgoing students. The United Kingdom, France, and Germany are the most popular host countries for ERASMUS and receive 50 percent of all exchanges (EC, 1994a).

Research and Development Expenditures

In 1993, the combined R&D expenditures of the Western European countries studied (EU and EFTA) were approximately $103.5 billion in 1987 constant dollars.[12] (Throughout this report, dollar amounts will be in 1987 constant PPP$.) Western European R&D expenditures amounted to 2 percent of the countries' combined Gross Domestic Product (GDP), with wide variation among countries. Greece invested only one-half of 1 percent of GDP in R&D, while Sweden invested more than 3 percent in 1993. In the same year, the total U.S. R&D expenditure was $137.3 billion, amounting to 2.7 percent of the national GDP. (See figure 8 and appendix table 9.)

[12] The R&D data on Western European countries reported here are derived from the *Main Science and Technology Indicators* of the Organisation for Economic Co-operation and Development, 1994, and from national R&D surveys. The R&D spending in 14 countries of the EU and 2 countries of the EFTA was combined to arrive at a regional total. No R&D data were included from Central European countries, although data are becoming available from Hungary and Poland. When purchasing power parity (PPP) conversions are available for Central European economies, a more comprehensive European R&D total can be derived.

Figure 8. Total research and development expenditures in Western Europe and the United States



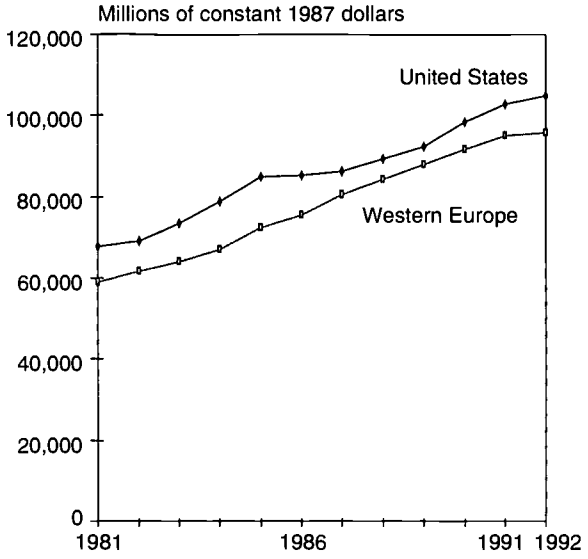
See appendix table 9.

While the level of overall U.S. R&D spending is considerably higher than that of Europe, European expenditures approach those of the United States in non-defense R&D. In 1981, the U.S. non-defense R&D was about 15 percent higher than Europe's. (See figure 9.) But by 1992, U.S. non-defense R&D expenditures were only 8 percent higher than those of Europe: $104.7 compared with $95.8 billion.

Sources of Research and Development Funds

Industrially funded R&D in Western Europe is somewhat less than that of the United States—representing approximately 53 percent of total R&D funding versus 57 percent in the United States. The rate of growth of industry's funding of R&D has also been somewhat less. During the period of 1975 to 1992, European, industrially funded R&D grew at an average annual rate of 4.9 percent; that of the United States, at 5.7 percent. (See figure 10.)

Figure 9. Non-defense research and development expenditures in Western Europe and the United States



See appendix table 9.

Europe performs as much university research as the United States, approximately $20 billion worth in 1992. (See appendix table 10.) European countries and the United States are similar in their major sources of support and performers of R&D. (See figure 11 and appendix tables 10 and 11.) European universities perform about 16 percent of overall R&D, as do U.S. universities. The amount of research performed by the government is greater in Europe than in the United States and reflects the stronger prevalence of national laboratories in these countries and their importance in the S&E labor market.

Science and Engineering Personnel

The combined sum of R&D expenditures of Western European countries has almost doubled during the period of 1975 to 1993. (See figure 12 and appendix table 9.) The number of scientists and engineers engaged in R&D has followed the same growth curve. (See figure 13 and appendix 12.) In 1991, research scientists and engineers numbered approximately 650,000, compared with about 960,400 in the United States. (See text table 5 and appendix tables 9, 12, 13 and 14.) The significantly larger number of research scientists and engineers (RSEs) in the U.S. labor force, as compared with Europe, highlights one U.S. strength that could be advantageous in science collaboration with Europe—sending young U.S. scientists and engineers to national laboratories and unique research facilities in Europe to work in innovative areas. European national laboratories are funded with long-term commitments for work in a particular field; any new opportunity in that field would be appropriate for them. Laboratory directors are not dependent on writing individual proposals for year-to-year funding, but they lack sufficient personnel to use their scientific resources fully. Issues related to combining the scientific strengths of the United States and Europe to mutual advantage are discussed in Implications for the United States.

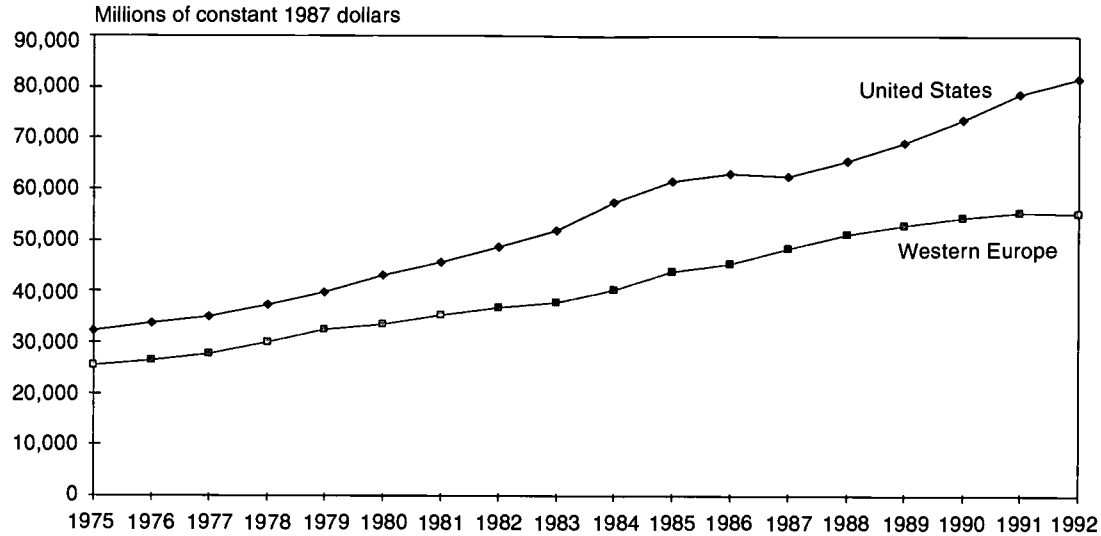
The rates of growth of research communities differed among individual European countries. Spain quadrupled the number of RSEs between 1975 and 1990, growing at an average annual rate of more than 10 percent, from 9,000 in 1975 to 38,000 in 1990. The number of researchers in the United Kingdom grew at a much slower rate, 2.5 percent annually during these years, but from a large base of around 80,000 full-time researchers in 1975. Since 1990, only Italy and the United Kingdom, among EU countries, have decreased the number of scientists and engineers employed in R&D. (See appendix table 12.)

Gross Domestic Product

The following section provides some information on the trends in economic growth from 1975 to 1993 and current estimates of the combined European economy. Central European countries are not included because of the current difficulties in obtaining accurate national accounts data from countries in transition to market economies. When these data become available, estimates of the total economic activity of the combined European countries will be considerably larger than those presented here.

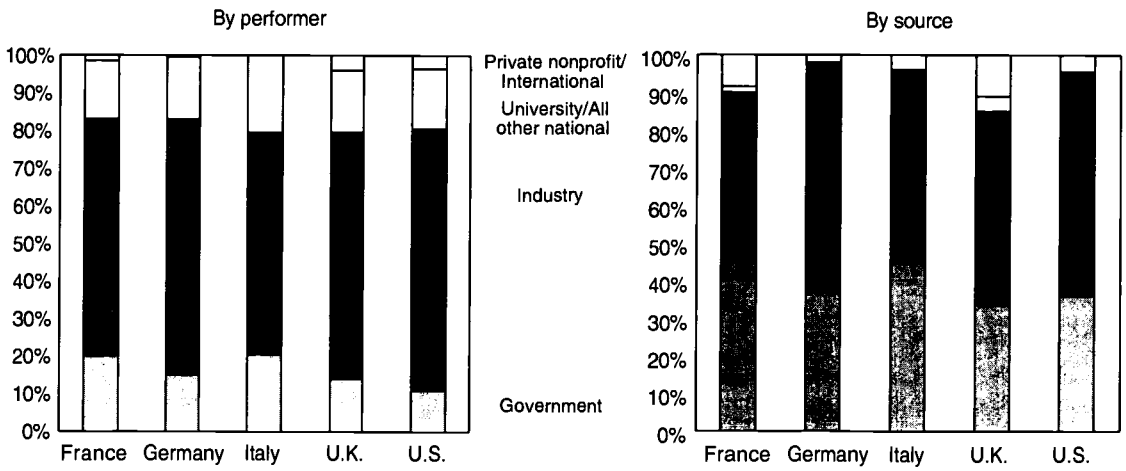
In 1993, the combined GDP of EU and EFTA countries was approximately $5.2 trillion in constant dollars, slightly higher than the GDP of the United States, which was $5.1 trillion. (See figure 14.) This represents a real growth rate in European GDP of about 2.3 percent annually from 1975 to 1993. (See appendix table 14.)

Figure 10. Industrially funded research and development in Western Europe and the United States



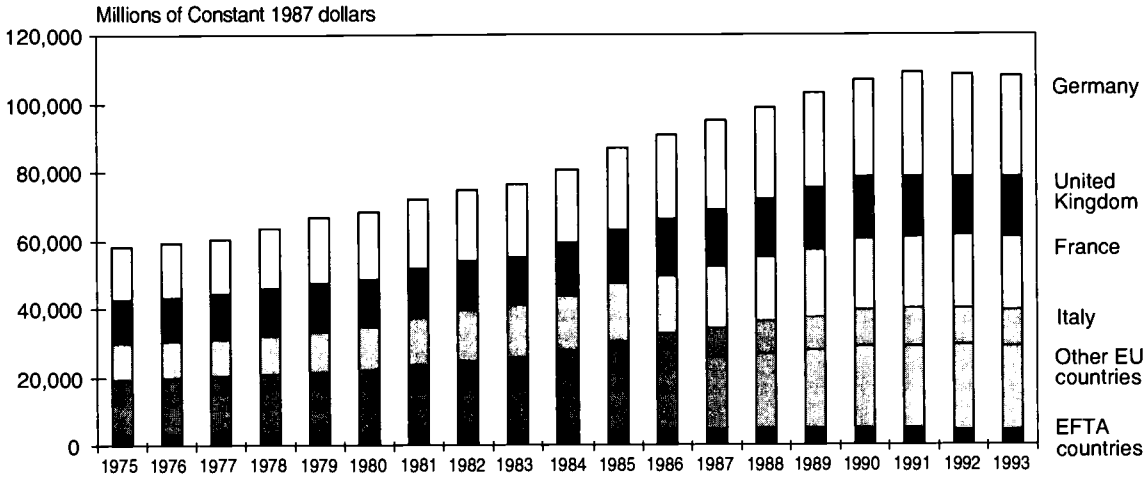
See appendix table 11.

Figure 11. Research and development in selected European countries and the United States: 1992



See appendix tables 10 and 11.

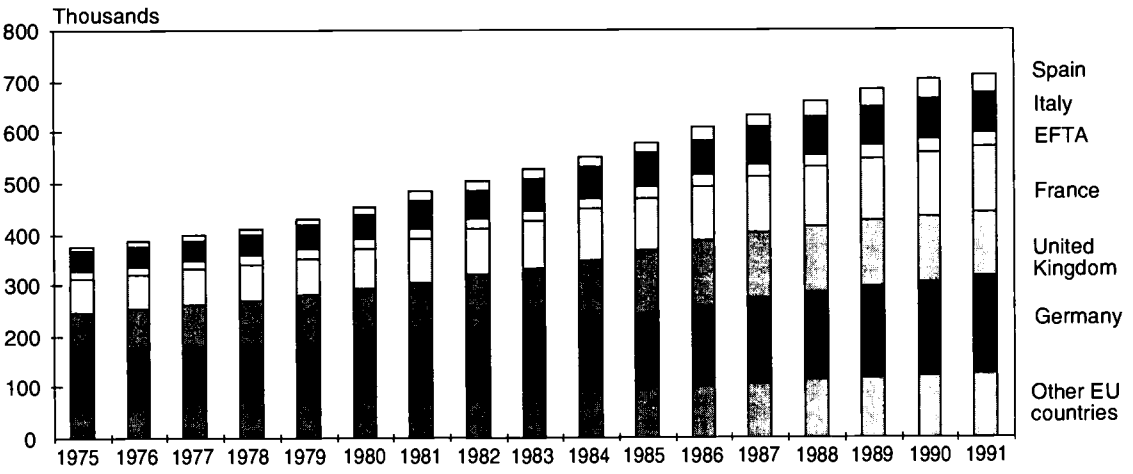
Figure 12. Research and development expenditures in selected European countries



EU = European Union; EFTA = European Free Trade Association

See appendix table 9.

Figure 13. Scientists and engineers in research and development in selected European countries



EU = European Union; EFTA = European Free Trade Association

NOTE: Numbers presented are full-time equivalents (FTE).

See appendix table 12.

Text table 5. Support for research and development and science and engineering personnel, by level of per capita gross domestic product in selected European countries and the United States: 1991

Country	Per capita GDP (PPP$)	R&D as a percentage of GDP	S&E personnel in R&D	S&E's in R&D per 10,000 of labor force
European Union				
Austria	14,471	1.4	8,800	26
Belgium	14,485	1.7	18,500	44
Denmark	14,917	1.7	12,049	41
Finland	13,296	2.1	14,030	55
France	15,548	2.4	129,205	52
Germany	14,350	2.6	191,329	49
Greece	6,655	0.5	6,230	15
Ireland	9,194	1.1	7,684	58
Italy	14,430	1.3	75,238	31
Netherlands	14,450	1.9	26,700	40
Portugal	7,066	0.6	5,900	22
Spain	10,315	0.9	37,700	46
Sweden	15,057	2.9	25,400	56
United Kingdom	13,779	2.1	126,000	45
European Free Trade Association				
Norway	14,594	1.8	13,460	63
Switzerland	19,005	2.9	14,300	40
United States	19,576	2.7	960,400	76

SOURCE: Computed from appendix tables 9, 12, 13, and 14.

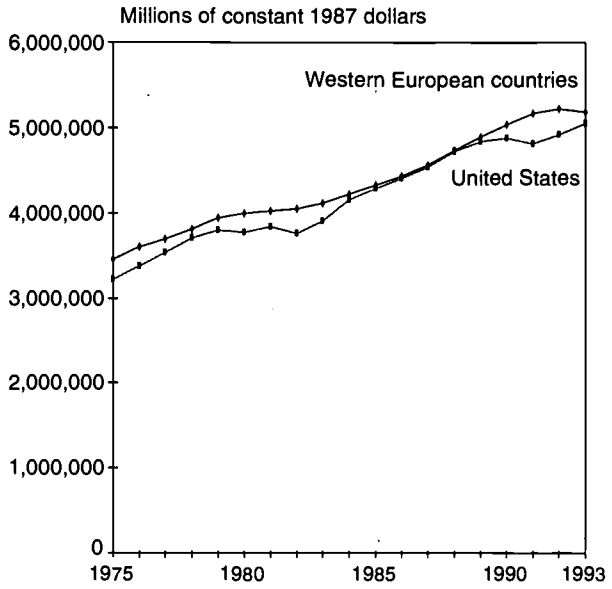
This average annual rate of growth in European economies during the past 18 years, however, combines the rapid growth of their economies in the 1980s with the slow growth and high unemployment of the early 1990s. The number of patents granted in the United States to inventors from the European countries reflect this same pattern, with a high rate of growth in the 1980s followed by a decline from 1990 to 1993. (See appendix table 15.)

Figure 15 shows the growth in GDP from 1975 to 1993 for selected countries in constant dollars. Five countries account for more than 78 percent of this total GDP: Germany, France, Italy, the United Kingdom, and Spain.

European Cooperation in Research and Development

Several Europe-wide programs are in place to develop and improve science and technology (S&T) cooperation among the countries of the region. Not all of these are EU programs.

Figure 14. Gross domestic product in Western European countries and the United States



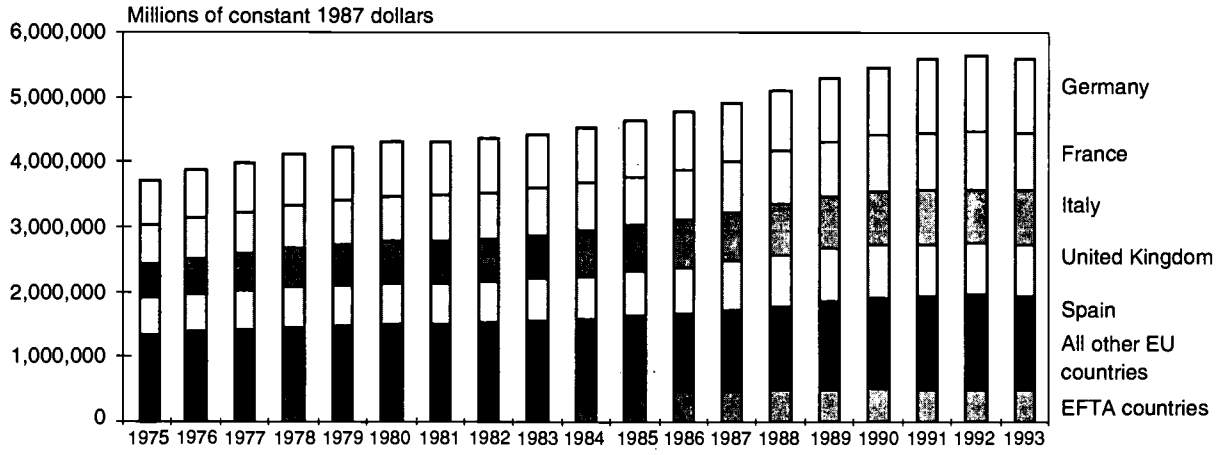
See appendix table 14.

Framework Programs for Research and Technological Development

Framework Programs are 5-year programs supported by the managing organization of the EU, the European Commission. The Framework Program supports and coordinates regional EU research, technology, and development actions and sets priorities and budget allocations for these S&T activities. Money for the Framework Program augments national R&D investments. The objective of the EU Framework Program is to strengthen the S&T bases of the region, contributing to its competitiveness at the international level.

Priorities for research changed in the four EU Framework Programs between 1984 and 1994. The first Framework Program (1984) concentrated on the need to develop alternative energy sources and allocated 50 percent of its funds to energy R&D. As the energy crisis subsided, the subsequent Framework Programs addressed other Europe-level needs. For example, since Europe manufactures fewer information technology products than it consumes, the European Community focused its

Figure 15. Growth in the gross domestic product in selected European countries



EU = European Union; EFTA = European Free Trade Association
See appendix table 14.

Framework Program in 1987 on stimulating advances in information technology (ESPRIT) and communications technology (RACE). As of 1993, these programs had not led to improvements in Europe's balance of trade in information technology and communication products and were re-oriented to integrate basic research, development teams, manufacturing experts, and end users.

The fourth Framework Program is considerably larger and broader than previous research programs, with funding at a level of 12.3 billion European currency units (ECU) (around $15.2 billion) for the period 1994 to 1998.[13] This program includes energy research, which represents 18 percent of the total, as well as other important research areas. For example, one of the 15 specific energy programs is the controlled thermonuclear fusion program of the EU, called the Joint European Torus, which aims to create safe, environmentally sound prototype reactors. As a next step in this fusion research, a quadripartite agreement was concluded in 1992 between Euratom, Japan, the Russian Federation, and the United States, to build an International Thermonuclear Experimental Reactor. The goal of this facility is to demonstrate controlled ignition of plasmas and, ultimately, the utilization of fusion power for practical purposes. Besides these traditional areas, which have received long-term stable funding from member countries, a new program of research related to socioeconomic impacts has been added to the fourth Framework Program. This research will include

[13] Prorated over the 5 years, these funds represent approximately 3 percent of total R&D expenditures.

Text table 6. Changes in the priorities of European Union framework research and development programs as a percentage of total program budget

	1984	1987	1991	1994
Total	100	100	100	100
Information and communications technology	25	42	38	28
Industrial and materials technology	11	16	15	16
Environment	7	6	9	9
Life sciences and technologies	5	7	11	13
Energy	50	22	16	18
Transport	0.0	0.0	0.0	2
Socio-economic research	0.0	0.0	0.0	1
International cooperation	0.0	2	2	4
Dissemination and exploitation of results	0.0	1	1	3
Human capital and mobility	2	4	9	6
Total program budget in million ECU	3,750	5,396	6,600	12,300
Total program budget in constant million dollars	4,500	6,475	7,920	14,760

ECU = European currency unit

SOURCE: Commission of the European Communities, *European Report on Science and Technology Indicators 1994,* European Commission, Brussels, 1994.

technological forecasting and research on educational improvements (EC, 1994b; Hellemans, 1995). (See text table 6.)

EUREKA

Another European cooperative effort in R&D (outside the EU Program) is geared toward industrial and applied R&D. Under the EUREKA program, consortia of firms in partnerships with universities and research institutes initiate a collaborative scheme and prepare a proposal on any project involving near-market R&D in advanced technology. EUREKA programs were established in 1985 to raise the competitiveness of Europe's industries and national economies in advanced technologies. Twenty-two European nations (EU countries and others) participate in scientific cooperation under this program, directed at developing products, processes, and services having a world market potential. Text table 7 shows the distribution of EUREKA projects in each technology area for 1992.

Text table 7. EUREKA projects, by technology area: 1992

Field	Percent of total
Total	100.0
Environment	22.1
Biotechnology	18.8
Robotics	18.8
Information technology	14.4
Materials	9.1
Transport	6.1
Energy	4.1
Communications	3.8
Other	2.8

SOURCE: Commission of the European Communities, *European Report on Science and Technology Indicators 1994,* European Commission, Brussels, 1994.

Consortia contribute their own funds and apply for partial public support from their own governments; the European Community (EC) provides for the costs of coordinating the research. EUREKA includes some large strategic projects, such as the Joint European Sub-Micron Silicon Initiative. In theory, Framework Programs would be followed by nearer-market research under EUREKA programs, but in practice one can proceed or follow the other. About a third of the participants conduct their research work under the two programs and find the rhythms of the two programs complementary: the more stable financial environment of the Framework Programs complements the creative initiative and cost-sharing under EUREKA (EC, 1994b).

Other European Cooperation in Research and Development

Significant Europe-wide cooperation has also occurred through several other programs and in shared use of facilities for several decades. The following organizations, while totally distinct from EU structures (the EC) play a significant role in European R&D programs. COST,[14] established in 1971, encourages cost-sharing in basic research in important areas, including telecommunications, materials, biotechnology, and agriculture. The European Space Agency, begun in 1975 for European cooperation in space research and technology and space applications, had a 1992 budget of 3.0 billion ECU, equivalent to about $3.6 billion.

The best-known and most significant shared facility is the European Center for Nuclear Research (known by its French initials, CERN) in Geneva, Switzerland. Almost 3,000 members of the European research community participate in high-energy particle physics, probing constituents of matter through shared use of a series of particle accelerator/colliders and associated detectors. CERN also provides access to thousands of visiting scientists from around the world, including U.S. researchers. Appropriately, it was in this vibrant research environment that scientists at CERN created the World

[14] COST is an acronym based on the French title "Coopération dans le domaine de la recherche scientifique et technique."

Wide Web. The 1993 budget of CERN reached $350 million, contributed by member nations.[15]

Other shared facilities for nuclear physics, located in Grenoble, France, include the European Synchrotron Radiation Facility (ESRF), with a 1993 budget of $58 million and 380 European personnel cooperating in condensed matter physics, and the Institute Max von Laue-Paul Langevin (ILL), a thermal nuclear facility with a 1993 budget of $40 million and 382 personnel (EC, 1994b). ILL, recently overhauled, is the world's premier source of neutron beams and supports research in physics, chemistry, biology, and materials science among the facility's three main funders: France, Germany, and the United Kingdom. Approximately 2,000 scientists visit ILL each year to conduct experiments on the more than 30 instruments around the reactor (Clery, 1995a; 1995c). U.S. scientists frequently use these research laboratories, and likewise, European scientists have access to U.S. facilities.

The European Southern Observatory (ESO) (headquartered in Garching, Germany), with a 1993 budget of $49 million, is constructing one of the world's largest optical telescopes in Chile. The ESO consortium of countries commits itself irreversibly to long-term stable funding. The European Molecular Biology Laboratory (EMBL), with a 1993 budget of $39 million, employs more than 700 scientists from member nations to carry out its on-site program. EMBL supports major facilities of strategic importance for molecular biology and biotechnology. The part of the EU Framework Program concerning the life sciences will include the expansion of infrastructure facilities to operate on a continental scale and the coordination of operations in bio-informatics, macromolecular structures, and genetic archives (Kafatos, 1994).

In addition to the above programs for cooperative research and shared use of facilities, several other prominent European science organizations help support European-wide science. These include the European Science Foundation (ESF) in Strasbourg, France, and the European Molecular Biology Organization (EMBO). The ESF, an association of 54 member research councils and academies in 20 countries devoted to scientific research, has been referred to as the "brains" of Europe (EC, 1994b). That organization advances European cooperation by providing leadership in basic science. Members meet to discuss cooperative research programs that will integrate the comparative advantage of participating member nations as well as to plan for the shared use of facilities. ESF planned the ESRF. The EMBO promotes concerted action in molecular biology research in Europe through publication of the EMBO journal, dozens of courses and 350 long- and short-term fellowships. EMBL, mentioned above, is a facility of EMBO. Their fellowships, workshops, and exchanges promote international collaboration and mobility of young scientists (EC, 1994b).

[15] Japan now contributes to CERN's budget (Daniel Clery, *Science*, May, 19, 1995, p. 969).

Country Profiles

Countries with very large systems of higher education and research communities, namely Germany, France, and the United Kingdom, will be highlighted separately. The remaining countries of the European Union (EU), European Free Trade Association (EFTA), and Central Europe will be discussed in groups.

Germany

Germany's accelerated growth in the 1960s created a demand for more skilled workers. The small number of students in secondary and higher education expanded to overcome this serious shortage. From 1975 to 1991, the number of students enrolled in higher education grew at an annual rate of 3.4 percent, from approximately 1 million to 1.8 million. University institutions and faculty initially expanded (from 1975 to 1985) to keep up with this growth; the lack of further expansion of university faculty since 1985 has resulted in overcrowding and a longer time to degree (Nerad, 1994).

Institutions

Although universities were not established in Germany until more than two centuries after comparable institutions appeared in England, France, and Italy, by the end of the 15th century there were nine such institutions, equal to the number of universities in France. The first of these universities was Heidelberg in 1386, followed by Leipzig (1409), Freiberg (1457), Munich (1472), Tübingen (1477), and Marburg (1527). Distinguished older universities in the former East Germany include Greifswald, Rostock, Jena, and Halle-Wittenberg. The University of Halle was the first university in Europe where lectures were given in the vernacular (German) rather than in Latin. Göttingen (1737) and the University of Berlin (1809) were, and remain, notable science centers.

In the 19th century, German universities were pioneers in changing and expanding their curricula to keep abreast of advances in science. The research university in its modern form originated at that time with the founding of the University of Berlin. Based on the plans devised by Wilhelm von Humboldt, German universities of the period set a new world standard by a skillful and successful combination of teaching and research (Miller, 1994). German eminence in mathematics has been evident since the 17th century when Gottfried Leibnitz invented the calculus independent of Isaac Newton in England.

Today (1993), German higher education includes 251 institutions, of which 70 are universities (including 6 private universities[16]), and 125 *Fachhochschulen.* Of these institutes, only graduates from the universities may continue their studies in doctoral programs. The university degree in Germany requires a minimum of 4 years of study, with the average length of undergraduate study lasting 6.5 years. This lengthy first university degree reflects both the quality of university education and the great overcrowding of universities occurring throughout Europe. University education is funded by the federal government and the *Länder* (states), and the number of institutions and faculty positions has not expanded in proportion to the increasing number of students (Von Friedeburg, 1991).

German polytechnics, called *Fachhochschulen*, prepare students for work in various technical specialties. Since this shorter first degree lacks research training, graduates from these institutions generally do not pursue advanced degrees. There is not an equivalent institution in the United States, but the bachelor's degree in engineering technology in U.S. universities is roughly similar to the

[16] One private university, Witten-Herdecke University in Nordrhein-Westfalen, was recently established and funded by private enterprises. Its graduates are assured of employment in participating industries.

Fachhochschulen engineering degree. *Fachhochschulen* were established in the early 1970s as an educational reform to address the serious shortage of skilled technical workers (Von Friedeburg, 1991). They have become increasingly attractive in the past 19 years to students with the *Abitur*[17] because of the relatively favorable employment prospect. German industrial firms consider this training to be more practical and focused on their needs (Tessaring, 1992). The *Fachhochschulen* are an important source of training for engineers, accounting for two-thirds of the engineering degrees awarded in Germany in 1992. (See text table 8.)

Germany would like to divert more of its engineering students from universities to *Fachhochschulen* and have an even greater percentage of graduates trained in these polytechnics. The German Government has established 26 new *Fachhochschulen* in former East Germany to create a more highly skilled labor force and to foster economic growth in that region (Gov. of Germany, 1993c).

Science and Engineering Degree Trends[18]

Despite a declining pool of students, Germany has continued to increase its output of science and engineering (S&E) degrees since 1975. The former West German college-age cohort declined 5.5 percent annually between the years 1985 and 1995 because of low birth rates in Germany beginning in the 1970s. (See appendix table 6.) The former East German college-age cohort declined more slowly (3.7 percent per year) during this same period. First university degree awards (includes *Fachhochschulen*) in science and engineering increased from 59,000 in 1975 to 106,000 in 1992, even as the number of college-age students decreased. (See appendix table 5.) S&E degrees have grown faster than overall university degrees. The number of natural science degrees awarded increased at a rate of 3.9 percent annually during the 17-year period. The number of engineering degrees grew even faster, 4.5 percent annually, while overall university degrees grew at just over 3 percent in this same time period (Gov. of Germany, 1993a).

The sharp increase in the number of degrees awarded from 1989 to 1990 reflects the inclusion of S&E degree data for former East Germany. (See figure 16 and appendix tables 16 and 17.) About 13 percent of the college-age cohort (27-year-old population for Germany) obtained a first university degree (includes *Fachhochschulen*) in 1992. Five percent of the college-age cohort obtained a degree in natural sciences or engineering in 1992, among the highest percentage achieved within EU countries. (See appendix table 1.)

The former East German *Länder* had a considerably higher percentage of their university degrees awarded in fields of science and engineering. Thirty-seven percent of all university degrees in East Germany in 1990 were awarded in engineering; only 21 percent of West German degrees were obtained in engineering in that same year. Nonetheless, the inclusion of the East German *Länder* only slightly increases the percentage of university degrees obtained in engineering since the East German population is relatively small (one-quarter that of West Germany) and access to university education was more restricted than in the West (8 percent of the college-age population versus 12 percent in former West Germany).

Access to university education for women in Germany has improved, particularly in fields of science and engineering, but from a low base. The percentage of women in the college-age cohort who obtained a university degree in former West Germany has increased from 7.8 percent in 1985 to 12.0 percent in 1991 (Gov. of Germany, 1993a). (See appendix tables 6 and 18.) In that same time period, the percentage of college-age women receiving natural science and engineering (NS&E) degrees increased from 1.2 to 2.3 percent—somewhat similar to the percentage of women with NS&E degrees in the United States and in South Korea. German women increased the number of university engineering degrees they obtained by more than 10 percent annually from 880 in 1975 to 4,218 in 1992. They increased their number of natural science degrees by 4.2 percent annually, from 6,052 in 1975 to 11,425 in 1992. (See figure 16.)

[17] Secondary school completion examination. Scores on this examination determine admission into particular university departments.

[18] The trends presented here will be for former West Germany for the years 1975–1989, with former East German data added for the years 1990–1992. Degree data are taken from the German national education statistics on higher education, annual series.

Text table 8. First higher education degrees in science and engineering in Germany, by type of institution: 1992

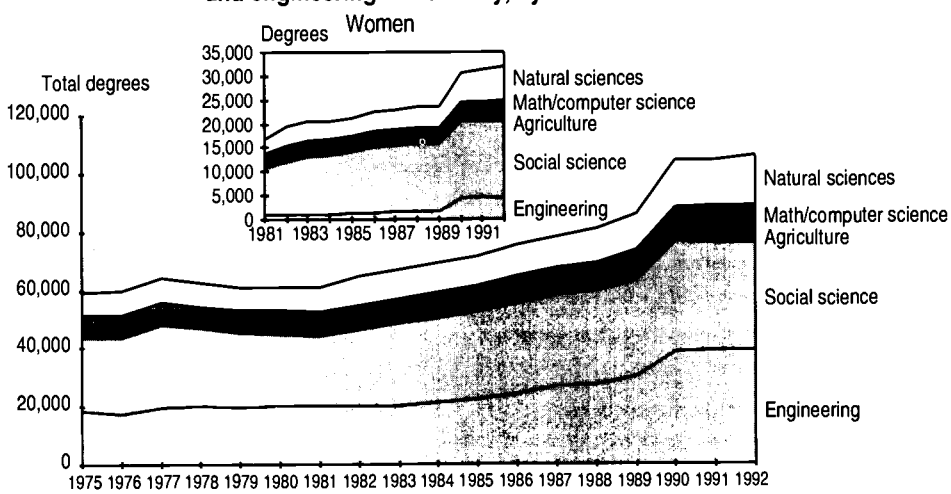
Field	Total first degrees	University degrees	Percent of total	*Fachhochschulen* degrees	Percent of total
Natural sciences	13,925	13,112	94	813	6
Mathematics/computer sciences	6,970	4,629	66	2,341	34
Agricultural sciences	4,815	2,621	54	2,194	46
Social sciences	37,120	20,371	55	16,755	45
Engineering	32,461	10,805	33	21,656	66

NOTE: Includes former West German degree data only.

SOURCE: Government of Germany, *Prüfungen an Hochschulen,* Statistisches Bundesamt Wiesbaden, 1993.

A larger share of NS&E degrees was obtained by women in former East Germany than in former West Germany. In the Eastern *Länder*, women obtained 54 percent of the degrees in the natural sciences and 28 percent of the engineering degrees in 1990 (Gov. of Germany, 1992). In former West Germany, females obtained 35 percent of the natural science degrees and 7 percent of the engineering degrees in that same year. However, the reorganization of the university system in the new *Länder* (former East German states) greatly reduced the number of university teachers and scientists, resulting in widespread expulsion of women from the middle

Figure 16. First higher education degrees in science and engineering in Germany, by field



NOTES: Data for 1975-89 are former West Germany data only; data for 1990-92 are for United Germany. Data include university and *Fachhochschulen* degrees.

See appendix tables 16 and 17.

academic levels (teaching assistants and lecturers) (Grimm and Meier, 1994).

The German Federal Government and the *Länder* Governments would like to raise the percentage of women among scholars and scientists. In the "Second Special University Program" the Federal and State Governments have budgeted DM 700 million annually (approximately $250 million in constant dollars) at the university level to increase female representation (Gov. of Germany, 1993c). The Federal States Commission for Educational Planning and Research Promotion has requested special annual reports on the realization of the specific promotion measures for female scientists (Gov. of Germany, 1993c).

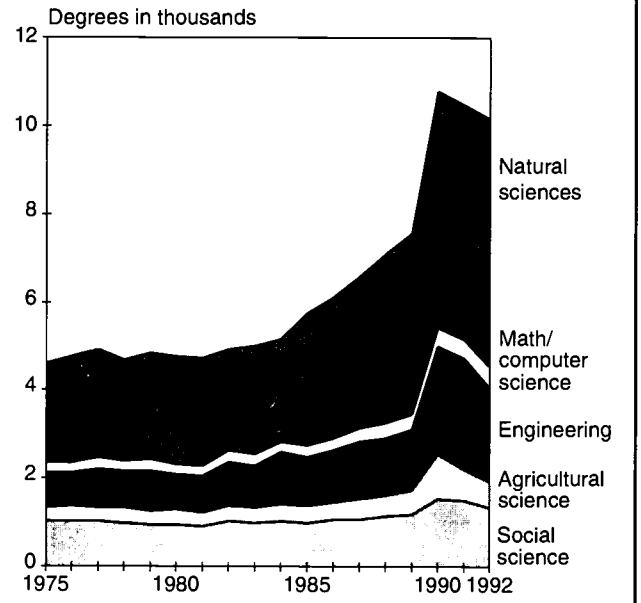
Doctoral Reform in Germany

Anticipating the need for highly trained personnel, German universities accelerated the education of scientists and engineers in the late 1970s. Doctoral degrees in science and engineering in former West Germany grew faster than overall doctoral degrees between 1975 and 1992. During this 17-year period, the number of natural science degrees increased 5.1 percent annually, engineering increased 4.8 percent annually, and overall degrees increased 3.4 percent annually. The number of NS&E degrees at the doctoral level accelerated in the second half of the 1980s. The large increase between 1989 and 1990 reflects the inclusion of doctoral degrees from the East *Länder* in the German data. (See figure 17 and appendix table 19.)

The number of doctoral degrees has reached a plateau in the 1990s, as Germany restructures doctoral programs both in former East Germany and throughout the country. Degree data for the East *Länder* show a large drop-off in doctoral degrees in science and engineering between 1990 and 1992. The number of natural science degrees declined by almost one-half, from almost 900 in 1990 to fewer than 500 in 1992. The number of engineering doctoral degrees awarded decreased by almost two-thirds, from 1,100 in 1990 to 400 in 1992 (Gov. of Germany, 1993a).

Germany is also concerned about the appropriateness of doctoral education throughout the entire country for providing the highly trained personnel needed for universities and emerging industries. In traditional

Figure 17. Science and engineering doctoral degrees in Germany, by field



programs, German doctoral candidates have no formal admission procedure or organized program of course requirements. The doctoral research is supervised by the professor who accepts the candidate. German doctoral programs have a very long matriculation time with low completion rates. In response to these concerns, Germany began an experiment in 1989 with a new structure for doctoral training called the *Graduiertenkollegs*. Students at these institutions have considerably more contact with faculty and participate in interdisciplinary study and research groups. "The primary goals of these *Graduiertenkollegs* are (1) to increase the number of trained doctorates; (2) to improve the quality of research training by providing a more suitable environment; (3) to prepare students for non-academic employment; and (4) to encourage innovative interdisciplinary work" (Nerad, 1994). Approximately 10 percent of doctoral students are in this experimental program.

Foreign Students

Foreign student enrollment in universities and *Fachhochschulen* reached 96,000 in 1992, representing approximately 6 percent of the total student enrollment. About half are from Europe, mainly Turkey, Austria,

Greece, and Yugoslavia. (Many of these are permanent residents who can essentially never obtain citizenship.) About 30 percent are from Asia, mainly Iran,[19] China, and Korea (Gov. of Germany, 1993b).

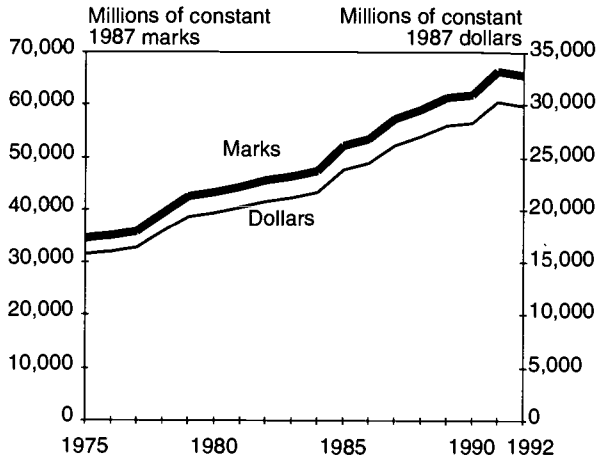
Foreign students receive approximately 12 percent of all engineering degrees at the doctoral level in Germany and about 7 percent of the natural science degrees. These percentages have remained relatively stable during the past decade (Gov. of Germany, 1993a). In the United States, the percentage of foreign doctoral recipients has increased in the past decade, to more than 57 percent in engineering[20] and 39 percent in natural sciences. (See text table 9.)

Research and Development

Germany is one of the most research-intensive industrial countries in the world, after Sweden, Japan and the United States. In 1993, research and development (R&D) accounted for approximately 2.5 percent of Gross Domestic Product (GDP), down from 2.9 before unification in 1989. R&D in Germany grew from DM 34,550 million in 1975 to DM 65,252 million in 1993 in constant currency, representing real growth of 3.9 percent annually during the 17-year time period. In constant dollars, this is equivalent to $15,776 million in 1975 and $29,660 million in 1993. (See figure 18.) Industry funds an increasing share of R&D in Germany, while the government share of support for research has decreased from 47 percent to 37 percent over the past 17 years (Fusfeld, 1994).

The dominant feature of structural change in German research is the reorganization of research in the new *Länder*. Commitments made for unification have placed a heavy burden on public research budgets to distribute R&D funds to build up former East German states while maintaining funding in the West. The Federal Government expended DM 1.4 billion in 1991 and DM 2.0 billion in 1992 (approximately $589 million and $790 million)[21] to improve R&D infrastructures, strengthen

Figure 18. Growth in research and development in Germany



See appendix table 9 and Organisation for Economic Co-operation and Development, *Main Science* and *Technology Indicators.*

industrial R&D, and restructure public research institutes (Gov. of Germany, 1994). Three new national research centers were established in the East: a Center for Molecular Medicine in Berlin-Buch, a Geological Research Center in Potsdam, and an Environmental Research Center in Leipzig/Halle. The 13 national research centers in western Germany will open branch institutes in eastern *Länder* (Gov. of Germany, 1993c).

In addition to new public research institutes, Germany also allocated DM 600 million (approximately $240 million in constant U.S. dollars) to various programs designed to support industrial R&D in the new Eastern *Länder* in 1992. However, Germany greatly decreased research personnel in industry in the eastern *Länder* to about 30 percent of the original level before integration. "The labor force of about 86,000 persons in industrial research in the former German Democratic Republic in late 1989 was reduced to about 24,000 persons in 1992" (Gov. of Germany, 1993c). R&D departments of former East German industry were largely dismantled. The transfer of institutions has so far not created a regional research system in East Germany, nor has it yet led to an integrated research system in a unified Germany (Meske, 1993).

[19] Middle Eastern countries are included in Asian geographic region.

[20] Including foreign students on permanent visas.

[21] In constant dollars.

Text table 9. Percentage of science and engineering degrees in higher education earned by foreign students in major industrial countries: various years

Country and field	First university				Doctoral			
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
	1981		1992		1983		1993	
United States[1]								
Natural sciences	3,484	2.9	4,556	4.3	1,928	21.1	4,863	38.7
Social science	2,835	1.5	3,741	1.8	881	13.7	1,604	23.1
Engineering	6,963	6.3	4,582	7.3	1,489	53.5	3,249	57.0
	1983		1992		1983		1992	
Germany								
Natural sciences	499	2.7	916	3.1	301	9.9	454	6.8
Social science	552	1.9	1,141	3.1	91	9.4	113	8.4
Engineering	1,145	5.7	1,491	3.8	113	11.6	246	11.7
					1989		1992	
France								
Natural sciences	NA	NA	NA	NA	1,037	30.1	988	34.5
Social science	NA	NA	NA	NA	183	44.9	270	37.9
Engineering	NA	NA	NA	NA	382	43.7	476	40.1
	1983		1992		1983		1992	
United Kingdom								
Natural sciences	988	5.7	1,013	5.3	761	27.5	1,020	26.7
Social science	NA	NA	1,588	12.1	NA	NA	374	52.1
Engineering	1,981	18.8	1,914	19.5	619	50.7	719	49.7
					1987		1992	
Japan[2]								
Natural sciences[3]	NA	NA	NA	NA	185	25.1	261	25.7
Social science	NA	NA	NA	NA	24	58.5	53	58.9
Engineering	NA	NA	NA	NA	188	30.3	436	36.8

NA = not available

[1] Includes permanent residents.

[2] Percentages are calculated on university based degrees only. Approximately half of science and engineering doctoral degrees in Japan are earned within industry.

[3] Natural science doctoral degrees to foreign students are mainly in the agricultural sciences.

SOURCES: United States—National Science Foundation, Science Resources Studies Division, *Doctorate Record File*; Germany—*Prüfungen an Hochschulen*; France—Ministère de l'Enseignement Superieur, *Rapport sur les Etudes Doctorales,* 1994; United Kingdom—Universities Statistical Record, unpublished tabulations; Japan—Monbusho Survey, unpublished tabulations.

One non-university institute that was revitalized rather than closed is the Central Institute for Microbiology and Experimental Therapy in Jena. One part of it became the Institute of Molecular Biotechnology (IMB), an important center for engineering biomolecules and for the underlying basic research. One hundred and fifty scientific personnel from the original institute, as well as top scientists brought from many countries, including biologists, mathematicians, physicists, and engineers, are working together on cutting-edge biology and state-of-the-art technology. IMB is becoming one of Europe's major centers in a new field: evolutionary biotechnology, allowing researchers to evolve molecules from natural products adapted to special purposes. The field requires the development of nanotechnologies for synthesizing and screening millions of samples and for detecting and capturing the single sought-after molecule. Because of strong industrial applications, 140 technology-based companies have started up in Jena since reunification[22] (Kahn, 1995).

Besides strengthening the research capacity of the new *Länder*, Germany is attempting to shift rapidly into leading-edge technologies throughout the whole economy. Germany is losing its market share in traditional products to lower-wage countries. The implication for R&D policy is the need to increase the efficiency of research in Germany and to translate scientific achievements into innovative marketable products. The German Government has begun a dialogue with industry on strategies and priorities of private and public research to identify emerging areas with high economic potential for the 21st century. The 1994 national debates on science, technology, and innovation reflect the concern of the Government to establish communication among the main bodies in research, technology, and development and to assess the national situation concerning science and technology (S&T) policy directions for the next several years. To initiate this dialogue, the Government set up a Council for Research Technology and Innovation, with members from the science and industry community, trade unions, and the Federal Administration. The Federal Minister for Research and Technology and the Federal Minister of the Economy will be responsible for steering the Council. (Gov. of Germany, 1993c.)

[22] Jena will be a science park in Germany.

The Federal Ministry for Research and Technology (known by its German abbreviation, BMFT) and the Ministries of the *Länder* are responsible for science and technology.[23] The *Länder* are responsible for research and higher education and, with the Federal Government, co-finance the Max Plank Institutes. State governments contribute 40 percent of the public financing of R&D. BMFT's determination to maintain the high level of basic scientific research is evident in their funding of the *Deutsche Forschungsgemeinschaft* (DFG). DFG, similar to the U.S. National Science Foundation, supports research in all fields of science and engineering, providing funds to individual investigators, large scientific equipment and computing facilities, priority programs, fellowships, and special programs for young scientists. DFG is the largest sponsor of university research ($593 million in 1990) and plays a major role in basic science. University funding accounts for the largest proportion of public R&D in Germany. BMFT is also responsible for innovation research in strategic key technologies, for accelerating the implementation of innovations by industry, improving S&T structures in the new Federal States, and improving the conditions for research and innovation in Germany (Gov. of Germany, 1993c).

Three current national R&D priorities are (1) to increase support for basic research, strengthen research with long-term prospects, and expand "preventive research" (e.g., environment, health, and climate); (2) to support industrial research in market-oriented technologies; and (3) to improve the basic conditions for innovation in small- and medium-sized enterprises. Germany's government-funded research is increasingly promoting application-oriented basic research. Federal funds are being directed toward promoting strategic technologies at the pre-competitive stage (especially information technology; biotechnology; and materials research, transport, and energy research) (Gov. of Germany, 1993c).

Research tax credits are a major source of public aide to industrial R&D. To maintain competitiveness, industry increased its share of support of total research from 50 percent in 1975 to 64 percent in 1988. Industrially funded research has since declined to 60 percent (1991). As in

[23] In late 1994, the BMFT and the Federal Ministry for Education and Science merged to form a super ministry, the BMBF.

many advanced countries, industry performs the large majority of research in Germany. (See appendix table 10.) In the late 1980s, industry performed 73 percent of all research. However, one recent analysis by a German researcher suggested that this industrial research may be too focused on innovations in their traditional product fields, in which Germany is less competitive than formerly, such as chemical and electrical fields (Atkinson, 1994).

Analysis of the German economy points out its traditional strength in advanced technologies in electronics, automobiles, and machinery, providing positive foreign trade results in the 1980s. One-third of all jobs in the German economy are tied to exports, which are being underpriced by lower-wage countries in Asia and Latin America. Germany's share of world exports in these traditional products has declined more than any other large industrial nation. Chancellor Helmut Kohl recently warned that Germany is far behind world competitors in such leading-edge technologies as computers, office technology, and lasers (Washington Post, 1994). Germany has yet to develop a strong biotechnology industry. Close links between universities and high-tech entrepreneurs are underdeveloped in Germany. The lack of venture capital also inhibits the start up of high-risk companies and service industries, as well as entirely new enterprises (Riesenhuber, 1991; Bitter, 1994).

France

In the past 10 years in France, there has been a remarkable desire of young people to pursue an undergraduate education and then graduate education, to which few had access (Courtillot, 1993). The reform and democratization of higher education in France, initially begun in the 1960s, have resulted in tripling both student enrollment and the number of universities. While subsequent growth was more moderate, French university education has begun a new period of expansion of access in the 1990s (Charlot and Pottier, 1992).

Anticipating a profound change in the structure of employment, France has the goal of educating 80 percent of its young people to the level of the *baccalaureat* (or *Bac*—6 year secondary school) by the year 2000. Since the *Bac* was traditionally a prestigious degree to which few could aspire,[24] the rapid expansion of the baccalaureate degree raises the issue of "watering down the bac" (Godet, 1993).[25] Nonetheless, the growth in numbers of young men and women succeeding in the *Bac,* especially in mathematics and in the technical and career fields, is creating a greater demand for higher education. In 1992, there were 1.3 million students in French universities, five times as many as a generation ago.

Institutions

The University of Paris, established in the middle of the 12th century, is the second oldest university in Europe and has been an important center of international scholarship since then. Two more universities were founded in France during the 13th century: Montpellier (1220) and Toulouse (1229). By the end of the 15th century, France could boast of nine universities located throughout the country. France was a leader in the development of engineering education in Europe in the 18th century. The *Ecole Nationale des Ponts et Chaussées*, established in 1747, is generally considered the first formal school of engineering in the world. The *Grandes Ecoles,* such as *l'Ecole Polytechnique*, begun during the French Revolution, were strengthened and upgraded by Napoleon to provide training in engineering and technical fields to the brightest students in France (Lambrech, 1993).

French strength in mathematics has been evident since the 17th century when René Descartes invented analytical geometry, introduced the deductive method in science, and applied mathematical analysis to the study of moving bodies. Descartes was one of several founders of the *Académie des Sciences* in 1666, next to the Royal Society, London, the world's oldest scientific society in continuous existence.

[24] Of the late 19th-century French authors, Gustave Flaubert passed his *Bac*; Emile Zola was unsuccessful.

[25] A similar controversy exists in Germany regarding the *Abitur,* the secondary school examination that ensures access to the university.

Today, institutions of higher education in France include universities; technical institutes; and *Grandes Ecoles* of engineering, business, and administration. The vast majority of students are in universities; only 90,000 students attend the prestigious *Grandes Ecoles* (Feldman and Morelle, 1994). Technology programs of a 2-year duration following the *Bac* grew rapidly in the 1980s at the University Institutes of Technology and the *Sections de Technicien Superieur.* There are also many specialized institutions of higher education of 2- to 3-year duration for professional training for paramedics, nurses, and education specialists (Charlot and Pottier, 1992).

In 1975, only 4.2 percent of the college-age cohort obtained a university education. This access to higher education tripled in 16 years: by 1992, 13 percent of young French men and women obtained a university degree. From 1975 to 1992, the number of NS&E degrees doubled, from 17,000 to more than 35,000. (Gov. of France, 1993.)

Even when the college-age cohort began to decline in 1985, the number of degrees in science and engineering continued to increase. The number of degrees obtained in natural sciences, mathematics, and computer sciences increased annually by 8 percent; engineering degrees increased by 3 percent in this same period. The percentage of the college-age cohort receiving an NS&E degree went from 1.9 in 1975 to 4.2 in 1992. (See appendix table 8.) (See figure 19.) Data on the number of social science degrees are incomplete; political science degrees, blended in with law degrees in French educational statistics, are excluded, as are degrees in social and behavioral sciences, which are blended in with humanities. (See Notes on Data Series.)

Some French scientists have argued that French education in the sciences lacks sufficient experimental work and individual initiative (Allègre, 1993).[26] For example, in French universities, nearly all of physics is taught on theoretical points, a small percent on numeric applications. Because of this, critics are concerned that French science, while traditionally contributing heavily in theoretical breakthroughs in mathematics, chemistry, and physics, does not translate easily into technology, except for chemical research used by private industry. To stimulate a more technological orientation, France recently established the Technological University of Compiègne, has sought to increase the number of engineering students who participate in experimental research as part of their education, and has promoted internship programs in industry. Prominent among these internships is a doctoral program partially supported by industry, *Convention Industrielle de Formation por la Recherche* (CIFRE), to conduct industrially relevant research (Charlot and Pottier, 1992).

France also introduced educational reforms (1982) to encourage girls to study science and engineering (Wilson, 1991). These reforms are showing an effect in recent education statistics. By 1992, more than 5 percent of college-age males and almost 2 percent of college-age females obtained a university degree in natural sciences or engineering. Women obtain one-half of the first university degrees in the social sciences, 35 percent of the degrees in natural sciences, and 19 percent of the engineering degrees. (See appendix table 20.) Women in France have the highest ratio of engineering degrees to total university degrees among any of the Western European countries studied. An estimated 7 percent of first university degrees[27] obtained by French women in 1991 were in fields of engineering. (See appendix table 21.)

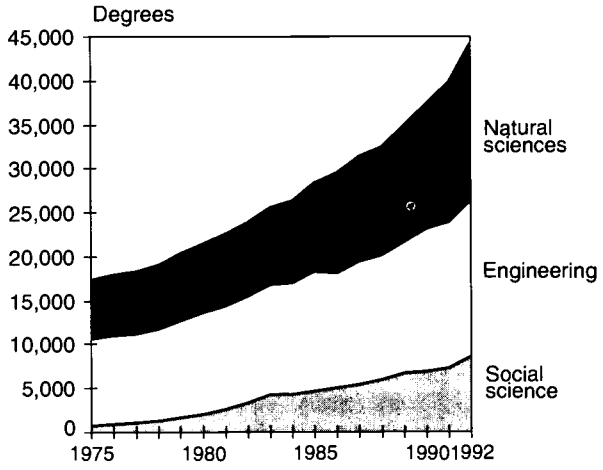
Doctoral Reform in France

In 1984, doctoral reform in France replaced multiple types of doctorates with a single doctorate, requiring 3 to 5 years of study and research. In 1988, France undertook a further reform of doctoral studies to double the number and improve the quality of doctoral degrees in science and engineering within 8 years. All the *dossiers* (program descriptions) of scientific specialties were reviewed for coherent coursework, research methods and equipment, and expertise of faculty. Those meeting all qualifications

[26] Claude Allègre served as Special Advisor for universities under Education Minister Lionel Jospin.

[27] Total university degrees include *Maitrises* degrees (4-year programs) and *Grandes Ecoles* (5-year programs for engineering). The number of engineering degrees obtained by women was taken from the Statistical Tables of the Ministry of Education, *Diplomes d'Ingénieur 1991*, Documentation Center, Vanves, 1992.

Figure 19. First university degrees in science and engineering in France



See appendix table 16.

were certified by the Director of Research and Doctoral Studies within the Ministry of Education (Gov. of France, 1992). The Paris and Versailles regions award the greatest number of doctoral degrees in the sciences. Large doctoral programs in science also exist in Grenoble, Nancy-Metz, Montpellier, and Toulouse. Besides universities, the national laboratories in France provide doctoral training. The Technological University of Compiègne has increased the number of doctoral programs in engineering (Gov. of France, 1994b).

The number of doctoral degrees in science and engineering increased from 6,000 in 1989 to 8,200 in 1992, close to a 27-percent increase (Gov. of France, 1994a). This rapid increase, particularly in mechanical, process, and civil engineering, has been supported through increasing government funding of research assistantships for doctoral students. In addition, CIFRE funds doctoral students and provides dissertation research opportunities in innovative areas of interest to private industry.

Women in France earn higher percentages of doctoral degrees in most NS&E fields than women in other European countries or in the United States. (See text table 10.)

Foreign students earn one out of three doctoral degrees in France in all fields of science, with variations among fields. In 1992, they earned less than 20 percent of the medical degrees, but 44 percent of the mathematics and 41 percent of mechanical, process, and civil engineering doctoral degrees. About one-half the foreign doctoral recipients in the natural sciences and engineering stay to work in France. Their return rate to their home country differs by field: in 1992, only 44 percent with mathematics degrees returned, but 80 percent of those with degrees in earth, atmospheric, and oceanographic sciences returned (Gov. of France, 1994b).

Research and Development

France, with a 1993 GDP of $879 billion, invested approximately 2.4 percent of its GDP in R&D. Industry financed approximately 45.7 percent of total R&D. With an expanding economy in the 1980s, France designated investment in research as a national priority, and R&D enjoyed high growth rates. Overall R&D in France grew at twice the rate of GDP throughout the 1980s, with more than 5-percent average annual increases, from 1980 to 1991. During this period, total R&D expenditures grew from 51 billion Francs in 1980, to 171 billion Francs in 1993. In constant U.S. dollars, the increase was from $12.6 billion, to more than $21 billion. From 1991 to 1993, neither the economy nor the R&D expenditures grew. (See figure 20.)

The level-funding in recent years in France, as well as several countries throughout Europe, is partly due to the global trend of reduced military R&D, and partly a result of France's rethinking its investments in science during a period of slow economic growth. Defense R&D investments grew steadily throughout the 1980s, reaching 42 percent of government R&D in 1988. This peak in defense spending was followed by sharp decreases: in 1991, only 35 percent of government R&D went to defense research (Gov. of France, 1995).

In 1993, France held a national consultation on strategic planning for French research policy and sent the resulting report to the National Assembly in June of 1994, with a request for steady increases in science budgets over the next 10 years (Goldsmith, 1994). The policy maintains

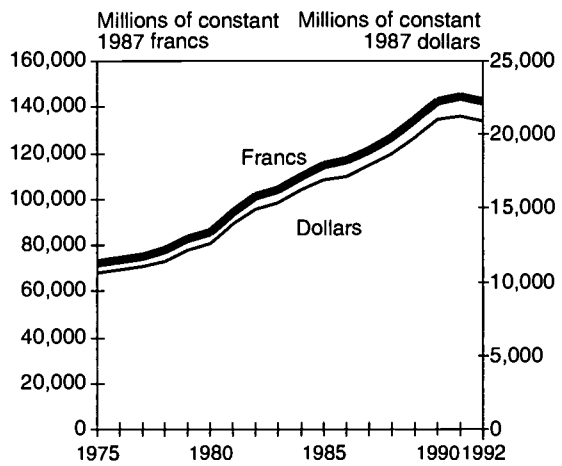
Text table 10. Percentage of science and engineering doctoral degrees earned by women in selected countries, by field: 1992

Field	France	Germany	United Kingdom	United States
Physics	18.7	7.1	12.7	12.1
Chemistry	33.8	21.0	24.5	26.2
Mathematics	20.0	18.0	17.9	19.4
Computer science	19.8	8.3	13.4	15.8
Social science	37.9	19.0	31.3	37.1
Electrical engineering	15.4	2.2	5.9	7.9
Mechanical engineering	19.5	3.9	10.3	6.7
Civil engineering	*	4.8	5.7	3.9

* Included in the percentage for mechanical engineering.

SOURCES: France—Ministère de L'Enseignement Superieur et de la Recherche. *Rapport sur les Etudes Doctorales.* 1994; Germany—Statistisches Bundesamt Wiesbaden, *Prüfungen an Hochschulen,* 1993; United Kingdom Universities Statistical Record, unpublished tabulations, 1993; United States—National Science Foundation, Science Resources Studies Division, *Selected Data on Science and Engineering Doctorate Awards: 1992,* Washington, DC: NSF, 1993.

Figure 20. Growth in research and development expenditures in France



See appendix table 9 and Organisation for Economic Co-operation and Development, *Main Science* and *Technology Indicators.*

basic research funding at the level of inflation, while proposed increases for R&D would go to applied research. The overall goal is to sustain R&D growth at 2.5 percent a year above the rate of growth of GDP (Balter, 1994b).

A key national priority for R&D policy is to encourage industrial support of research. To this end, government support of total R&D declined from 54.2 percent in 1975 to 44.3 percent in 1992, while industry somewhat increased its support from 30 percent in 1975 to 44.7 percent in 1992. Industry performs 61 percent of all research. In addition, there is a strong trend toward internationalization of industrial R&D in large enterprises. Foreign financing of industrial R&D increased from 6 percent in 1980, to 12 percent in 1993, particularly for industries involved in the European Space Agency, Airbus, and European Community programs (Gov. of France, 1995).

For public research, France established a network of national scientific laboratories, beginning in 1939—the National Committee for Scientific Research (known by its French abbreviation, CNRS). By 1993, more than

1,000 CNRS laboratories or affiliated laboratories employed more than 11,300 scientists and 7,500 engineers to conduct research in a wide range of fields, including the physical and mathematical sciences, nuclear physics, engineering, science of the universe, chemical and life sciences, and social and behavioral sciences. CNRS also conducts interdisciplinary research on environment, cognition, materials science, and nanotechnology. Other major public establishments are devoted to medical research (INSERM), nuclear sciences (CEA), agronomic research (INRA), computer and information science (INRIA), space research (CNES), and oceanographic research (IFREMER).[28] These national laboratories conduct about 22 percent of all research in France (Gov. of France, 1995). Roughly half of French scientists involved in basic research are civil servants who work full time on research at laboratories run by government agencies such as CNRS and INSERM (Balter, 1994a).

Universities conduct 16 percent of the overall research in France and employ more than 26,000 scientists and engineers in research and teaching positions. Universities have attempted to link their research with the major facilities available in CNRS laboratories and to the needs of industry. Doctoral students can conduct their dissertation research on a problem pertinent to industry, under partial industrial support of their graduate training (CIFRE). The strategic plan for R&D submitted to the National Assembly discusses additional incentives to exchange scientists between national laboratories (CNRS), universities, and industries (EC, 1994b).

The development and employment of young researchers, both within France and from developing countries, is also a priority area. Within France, the number of research scientists and engineers in full-time equivalents almost doubled in the past 16 years: from 29,000 in 1975, to 53,000 in 1991. (See appendix table 12.) Most of the growth occurred in industry; almost half of these researchers are employed by industry, a third in higher education, and 20 percent in national laboratories. In addition, CNRS recently signed an agreement with the United Nations Educational, Scientific, and Cultural Organization (UNESCO) for the training of young researchers from developing countries. Similar program agreements already exist between UNESCO and the French universities (NSF, 1994a).

At the national level, France structures its Funds for Research and Technology through the *Grands Programmes*—megaprojects in areas of scientific priority that have a socioeconomic or strategic objective and require the mobilization of multi-year funding. In 1993, France expended approximately 12 billion Francs ($1.6 billion in constant U.S. dollars) on the *Grands Programmes* in three categories: (1) Very large facilities with timetables for achieving some S&T milestones, including space research (CNES), the synchrotron radiation facility, and nuclear reactors. These are generally co-financed by many international partners. (2) Programs for basic understanding and advancement of knowledge with no fixed times or targets, such as AIDS, genome and protein research, and global change. In these areas in particular, continuity of funding is indispensable for meaningful research results. (3) Finally, those programs somewhere between fixed time-tables and open-ended investigations including areas such as information systems, Joint European Sub-Micron Silicon, and other microelectronic projects, and high-definition television. These final programs have partnerships with consortia of industries. The level of French support for some of these programs in 1993 is provided in text table 11 (Gov. of France, 1995).

France is also a major supporter of several very large multinational regional facilities, including the European Center for Nuclear Research (CERN) in Geneva, the CERN project on the Large Hadron Collider for particle physics, the European Southern Observatory in Chile, a large telescope in Hawaii, and several oceanographic research vessels. Two important multinationally supported facilities located in France (both in Grenoble) are the thermal neutron facility, Institute Laue-Langevin and the new (1994) European Synchrotron Radiation Facility (ESRF), which is used by researchers in a wide range of scientific fields, primarily condensed matter physics, molecular biology, and microelectronics.

[28] Institut National de la Santé et de la Recherche Médicale (INSERM); Commissariat à l'Energie Atomique (CEA); Institut National de la Recherche Agronomique (INRA); Institut National de Recherche en Informatique et en Automatique (INRIA); Centre National d'Etudes Spatiales (CNES); and Institut Français de Recherche l'Exploitation de la Mer (IFREMER).

Besides these large facilities for big science, and a network of national laboratories, other key dimensions of S&T infrastructure exist in France. Several research groups from public organizations, university laboratories, and private institutions are coordinating their research on the evolution, mapping, and sequencing of genes. This work is part of an International Human Genome Research Project, to which French scientists are important contributors.[29] In addition, the Pasteur Institute, a private foundation established in 1887, has more than 100 laboratories conducting basic research to fight infectious diseases and a teaching hospital specializing in their treatment. The Pasteur Institute contributes to public health research throughout the world and has made a very large investment in AIDS research[30] (Gov. of France, 1995).

France is attempting to broaden geographic distribution of R&D, and narrow the disparities between the most prestigious research universities and those that do little research. In 1994, the French Science Minister proposed plans to eliminate 80 positions for teacher-researchers at six leading French universities to create new posts at campuses with few professors who do research (Kaiser, 1994).[31] New CNRS facilities and responsibilities are also being shifted from the Paris region to reduce the concentration of research in the capital and strengthen it in several regions. CNRS recently mandated that two-thirds of all new appointments must be outside the Paris region.

[29] An International Conference on the Human Genome held in Washington, D.C., in July, 1994, had several French contributors.

[30] It was from one of these Pasteur labs that a virus sample was sent to NIH and used to make a blood test, resulting in a decade-long controversy on intellectual property rights. In 1994, NIH acknowledged that the Pasteur virus was used by NIH scientists to develop the American HIV blood test, which was patented. "The French virus was used by NIH scientists in developing the American test kit" (Harold Varmus, *Science*, July 1, 1994, p. 25).

[31] This proposal has been highly criticized by the leading French universities.

Text table 11. Level of research support for Grand Programs in France: 1993, by program area

Program areas	Percentage of Grand Programs Research support	Millions of constant 1987 dollars
Large facilities		
Space transport	18.9	302.3
Aeronautics	8.7	138.6
Satellite observation earth, ocean sciences	6.9	109.7
Socio-economic or strategic objectives		
Biochemistry of proteins	10.3	165.0
AIDS research	3.8	60.7
Engineering macromolecules	2.6	40.9
Genome research	2.3	36.3
Global change research	1.5	23.8
Projects with industrial participants		
JESSI and other microelectronic	6.7	106.9
HDTV	3.4	54.0
Biology/environment	3.4	54.0
Process engineering	1.5	23.7

SOURCE: For complete list of Grand Programs, see Government of France, *Projet de Loi de Finances Pour 1993,* National Printer, Paris, 1995, p. 175.

United Kingdom

Traditionally, only about 15 percent of U.K. students continued the "Sixth Form" (upper-level of senior high school) which prepared them to enter higher education after "A level" examinations (secondary school examinations for entry to the university). The "Fifth Form" (standard schooling) ends at grade 11. Many students opted out of continuing their education because upper-level high school, for 16- to 18-year-olds, required declaring a major field and total emersion in that coursework (Masters, 1994).[32] The 1988 Educational Reform Act introduced a National Curriculum to provide the academic background for more students to continue in school past 16 years of age, with increased options to study science, and subsequently enter the university (Gov. of U.K., 1994b). Recently, the U.K. higher education system has allowed non-traditional entry qualifications in engineering, substituting technical coursework for A-level examinations. These educational reforms were based on the Government's desire to raise access to higher education to be more in line with other Western European countries (Wilson, 1991). These reforms contributed to expansion of university enrollments, increasing from 15 percent to 35 percent of all 18- to 19-year-olds in the 5-year period 1988–1993. In addition, adults are returning for higher education (Gov. of U.K., 1994a).

Institutions

Oxford, founded late in the 12th century, and Cambridge, founded in the early 13th century, were the first universities in what is now the United Kingdom, and among the oldest in Europe. By the end of the 15th century, there were five universities in the United Kingdom, including St. Andrews (1411), Glasgow (1494), and Aberdeen (1494). It was at Trinity College, Cambridge, that Sir Isaac Newton invented the differential calculus and, in 1687, published his monumental *Principia Mathematica*, which enunciated his three general laws of motion and his law of gravitation which, taken together, described and predicted precisely the motion of all objects in the solar system. Newton was among the first members of the Royal Society of London, chartered in 1660, the world's oldest scientific society in continuous existence.

Until recently, higher education institutions in England and Wales divided into three sectors: universities, polytechnics, and colleges. Most provide 3-year degrees (following a 13-year elementary and secondary program), although NS&E fields are usually longer. The universities validate and award their own degrees. In the polytechnics and colleges, degrees are validated by an external body, the Council for National Academic Awards. The universities are the longest established of the three sectors. Colleges were founded in the late 19th century for training personnel for local employers. Thirty polytechnics were created in the 1960s to widen access to higher education to groups traditionally underrepresented. They were to have a vocational focus, but the course offerings of the polytechnics have gradually become similar to those of universities. In 1992, most polytechnics attained university status[33] (Gov. of U.K., 1994c).

The 46 existing universities retained their role as prime providers of research and still account for the large majority of natural science degrees.[34] Only about half of the engineering and computer science degrees, however, are obtained in universities; the other half are obtained in polytechnics and specialized colleges (Tarsh, 1992). Women make up half of the student enrollments in higher education in all institutions. The massive expansion of higher education has not led to similar expansion of hiring permanent Ph.D. faculty, although there was a big expansion of short-term contract for research assistants. The ratio of students to professors has greatly increased in the past 10 years, resulting in more teaching assistants and doctoral students teaching courses (Jagger, 1994).

Science and Engineering Degree Trends

Half of the first university degrees in 1992 were awarded by universities, 45 percent by polytechnics, and 5 percent from open universities (Gov. of U.K., 1994c). Time series data (1975-1991) are shown for traditional universities only. (See figure 21.) The U.K college-age population

[32] This applies to England and Wales; Scotland's system is different.

[33] The Further and Higher Education Act of 1992.

[34] British university education in the natural sciences is still considered by many to be among the strongest in Europe.

started to decline in 1981 (World Bank, 1993). A few years later, the number of engineering degrees began to decline. Unlike the United States, however, absolute numbers of combined natural science and engineering degrees did not continue to decline. The number of engineering degrees has remained relatively stable since 1987. Natural and social science degrees fluctuated during the period 1975 to 1992, agricultural sciences degrees remained flat and math and computer science degrees increased. (See figure 21.)

Over half of total university degrees awarded in the United Kingdom in 1991 were in S&E fields, almost a quarter in natural sciences alone. (See appendix table 2.) Only about 10 percent of the college-age cohort obtained a university degree in 1991. Participation rates increased to 20.8 percent in 1992 with inclusion of degree data from colleges and polytechnics in the U.K. university system. (See appendix table 1.)

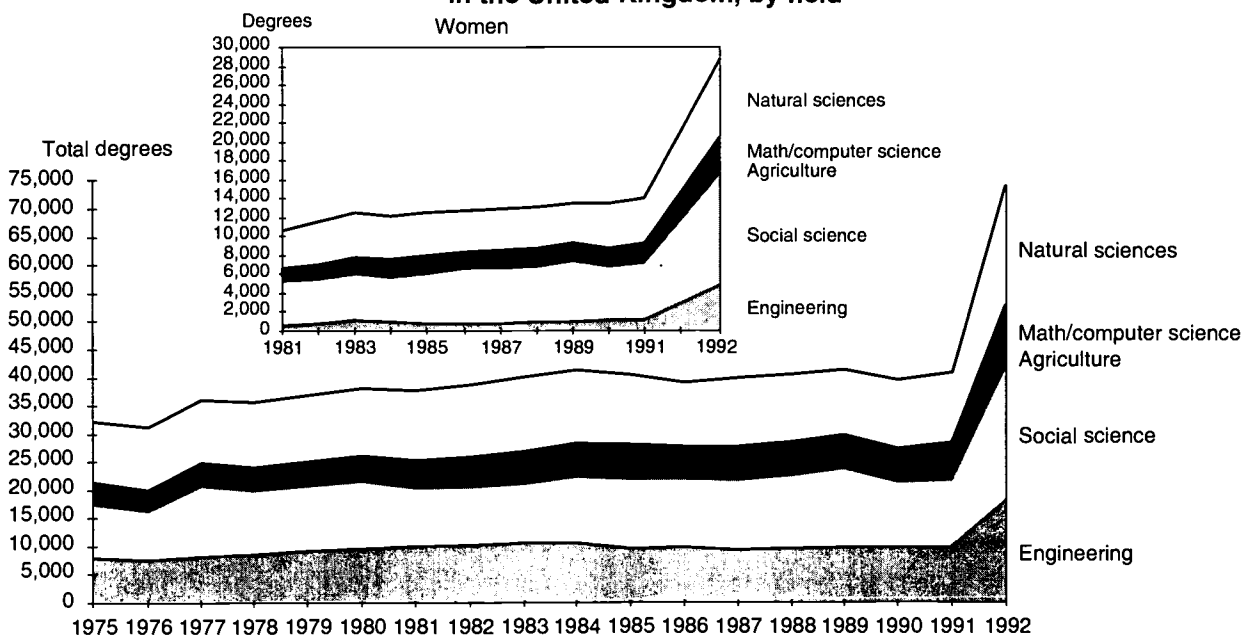
The number of doctoral degrees in fields of science and engineering did not increase as fast as overall doctoral degrees. Doctoral degrees in all fields grew 2.7 percent annually from 1975 to 1992. The number of natural science degrees grew slightly less: 2.3 percent over this same time period, from 2,000 degrees in 1975 to 3,000 degrees in 1992. The number of engineering degrees grew more slowly: 1.3 percent from 1975 to 1992, from 1,000 to 1,300 degrees. (See figure 22.) Women represent 27 percent of the natural science degrees and 11 percent of the engineering degrees at the doctoral level (Gov. of U.K., 1993; Sutherland, 1994). (See appendix table 19.)

Traditionally, national laboratories have played an important role in supervising graduate research. This persists in Belgium and France, but has declined dramatically in the United Kingdom (Healey, 1994c).

Foreign Students

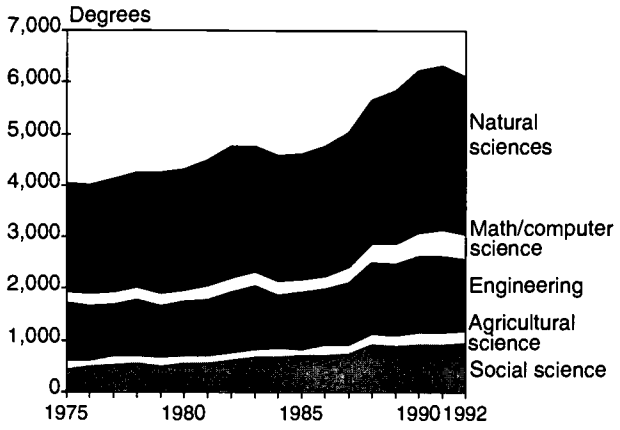
The United Kingdom has a long tradition of training students from the Empire and former British colonies. In 1992, the number of foreign students enrolled full time in U.K. universities reached 93,000, out of 934,000 total full-time students in higher education. About 45,800 were

Figure 21. First university degrees in science and engineering in the United Kingdom, by field



See appendix tables 16 and 17.

Figure 22. Doctoral degrees in the United Kingdom, by field



See appendix table 19.

studying for a first university degree, representing about 6.7 percent of the 687,000 undergraduates in the United Kingdom. About 32,000 were studying at the graduate level, representing 31.2 percent of the 102,500 graduate students. These percentages of foreign students at the graduate and undergraduate level have not changed significantly in the past 10 years (Gov. of U.K., 1994c). Recently, however, a larger proportion of foreign students in the United Kingdom are from EU countries. In 1992, 27,675 students from Germany, Ireland, France, and Greece were studying in the United Kingdom, representing about one-third of all foreign students.

Research and Development

In 1992, the U.K. government established a new cabinet secretary to improve the handling of S&T policy and created the Office of Science and Technology (OST). This office is responsible for the science budget of the Research Councils and the block grants to the Royal Society and the Royal Academy of Engineering. This reform of science policy structure and funding is intended to build closer and more systematic partnerships among researchers, government, and industry. In addition, in 1994, OST began publishing a *Forward Look of Government Funded Science, Engineering, and Technology,* giving an assessment of the portfolio of publicly funded research best suited to the broader S&T needs of the country.[35]

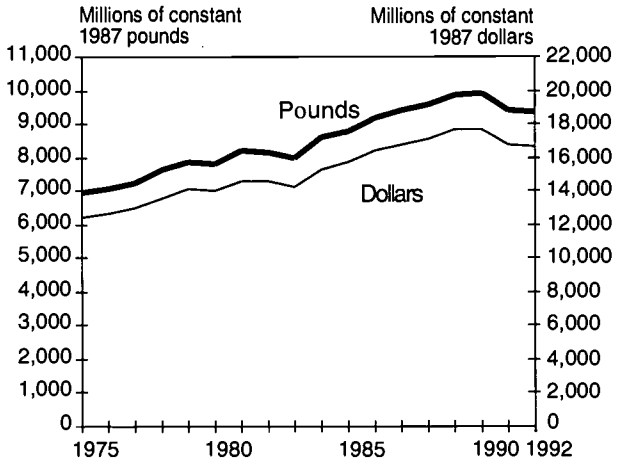
The United Kingdom had a 1993 GDP of $796 billion and invested about $17.7 billion, or 2.2 percent of GDP in total R&D. Industry financed about 50 percent of total R&D. Throughout the 1980s, the U.K. government has been determined to secure greater industry funding of R&D and has succeeded. Industry support of overall R&D increased from 38 percent in 1975 to 52 percent in 1993. The government reversed positions with industry, decreasing its support of overall R&D from 54 percent in 1975 to 32 percent in 1993. Industry also increased its share of the performance from 1975 to 1993, from 58 to 62 percent of all research conducted in the United Kingdom. Government performance of total research decreased from 25 percent in 1975 to 14 percent in 1992.

Overall R&D expenditures in the United Kingdom grew at an annual rate of 2.6 percent throughout the 1980s and have since leveled off and slightly declined. (See figure 23.) This is the same pattern for all major European countries: great growth in the 1980s, and a pause in the 1990s to assess the benefits of this investment. Some of the decline of government R&D in the United Kingdom in the 1990s was due to budget cuts in the military and civilian departments. In 1992, the Ministry of Defense research funds were decreased to 42 percent of government R&D, from 55 percent of overall government R&D funding 5 years prior. Defense research funding is projected to continue to decrease by 15 percent in real terms between 1993 and 1996. The Ministry of Defense R&D is now in the Defense Research Agency; like Advanced Research Projects Agency, it is semi-privatized and expected to receive contract research. The number of S&E personnel was decreased, as reported in the outlook report (Gov. of U.K., 1994d).

The government also cut civilian research in government departments. For example, the Department of Trade and Industry (DTI) had been funding collaboration schemes for industrial innovation through four major programs: LINK, EUREKA, advanced technology, and general industry programs. LINK is a program for pre-

[35] OST is no longer a cabinet office and is now under the Department of Trade and Industry, which has responsibility for the S&T budget.

Figure 23. Growth in research and development in the United Kingdom



See appendix table 9 and Organisation for Economic Co-operation and Development, *Main Science and Technology Indicators.*

competitive research between industry, academia, and multiple government departments. EUREKA[36] promotes industry to develop advanced technology for commercial success within the European market. Under general industrial collaborative projects, DTI supports research and technology organizations that specifically encourage small- and medium-sized enterprises to participate. With cuts in government spending for R&D, DTI has decreased aid for small and medium industry, and the Department of Agriculture eliminated its near-market research. Further, the government drastically cut the Department of Energy funding of the fast breeder reactor research and subsumed the Department of Energy under DTI. The U.K. Atomic Energy Authority is now a public corporation (Gov. of U.K., 1994d).

The United Kingdom has privatized some national non-defense laboratories, which have moved from more basic, long-term research to more commercial short-term activities. National laboratories in Europe are an important, but declining, employer of scientists and engineers. U.K. laboratories have the steepest decline in employment, with very little mobility of scientists and engineers. France and Belgium are achieving some renewal of S&E personnel in their stable national laboratories through the use of graduate students as an integral element in the research organization (Smith, 1994).

Government funding of university research by the Research Councils and the Higher Education Funding Council has been maintained despite shrinking annual government R&D budgets. It now represents 35 percent of government support of R&D, approximately $2 billion (Gov. of U.K., 1994d). The six Research Councils, such as the Engineering and Physical Sciences Research Council and the Medical Research Council, have established nine interdisciplinary programs through large grants to academic research centers for strategic research to provide post-graduate training. These strategic research centers are tied to industry-supported technology, such as optics and lasers. However, the recent downsizing of U.K. industrial research has limited the opportunities for U.K. industry to work with universities. While government performance of research was reduced by almost 1 percent annually between 1975 and 1992, university performance of research increased more than 3 percent annually during this same period. U.K. universities now perform approximately 16 percent of total R&D, similar to the percentages for university performed research in France, Germany, and the United States. (See appendix table 10.)

About 5 percent of the Research Council's $2 billion 1995 budget has been earmarked for a set of priority initiatives in applied research defined by the government. These include the Human Genome Project ($6.2 million), bioprocessing, wealth-creating products from plants, and several other research areas that would enhance the country's economy (O'Brien, 1995). U.K. scientists have been particularly active in the Human Genome Project. The Director of the Genetics laboratory at Cambridge has proposed jointly with an American geneticist—the director of the Genome Sequencing Center at Washington University in St. Louis—a way to quicken the pace of large-scale DNA sequencing. With the benefit of several laboratories working in tandem, they propose to cover the entire human genome in 5 years and lower the entire bill for biomedical research (Marshall, 1995).

[36] EUREKA is a pan-European initiative to facilitate collaborative R&D between European companies and research organizations.

The number of research scientists and engineers (RSEs) also expanded in the 1980s and contracted in the 1990s. RSEs increased from 79,000 in 1975 to 130,000 in 1989, representing a 3.6-percent growth rate during this period. (See appendix table 12.) The United Kingdom is one of the few countries in the EU that has decreased the number of full-time employed RSEs in the 1990s, while increasing temporary or contract work. In addition, U.K. scientists are less well-paid on average than their European counterparts (Healey, 1994b). Business enterprises, Research Councils, and government departments have all decreased their numbers of scientists and engineers engaged in research in the past 6 years. These reductions have been a factor leading to departures of British RSEs to the United States and other parts of Europe (NSF, 1995a). Only U.K. higher education institutions have hired new RSEs in this period.

The United Kingdom is very active in international collaborations in the Airbus, the European Space Agency, and CERN. The United Kingdom is also heavily involved in the Framework Programs that aim to strengthen the underlying S&T basis of European industry as a worldwide competitor, such as IT, RACE, AIM, and BRITE.[37] Four percent of U.K. government R&D expenditures went to the support of the European Community (EC) Framework Programs. A growing fraction of the U.K. R&D budget is supported by the EC international cooperative science program (EC, 1994b). "Foreign" sources of support for total R&D grew from 2 percent to 12 percent in the 1980s. To secure external research funds, U.K. universities are collaborating in EU programs with industrial partners from other countries for pre-competitive research (Healey, 1994d).

Other Countries of the European Union

In the discussion that follows, countries are grouped by the size of their higher education system or R&D expenditures and by geographic proximity. Italy and Spain are EU countries with very large university systems and considerable R&D investments. Next in size are the Northern European countries: The Netherlands, Belgium, and Denmark. Ireland, Greece, and Portugal joined the EU in the 1980s and are the recipients of EU cooperative programs to strengthen their research base. Sweden, Finland, and Austria are the newest EU members, grouped to show their contribution to the EU. Norway and Switzerland are the remaining countries of EFTA. Central European countries are discussed in a group.

Italy

Italy has the third largest higher education system in Europe after France and Germany, and the oldest university in Europe, established at Bologna in the 11th century. Five more universities were founded during the 12th and 13th centuries, including Milan (1175), Pavia (1200), Naples (1222), Padua (1222), and La Sapienza in Rome (1310). By the end of the 15th century, there were 15 universities in what is now Italy, 3 less than in France and Germany combined (Academic American Encyclopedia, 1994b). Several were to become notable as scientific centers. Galileo carried out his first telescopic discoveries that helped revolutionize astronomy in 1608–1609 while Professor of Mathematics at the University of Padua in the Venetian Republic. He was also one of the first members of the *Accademia de Lincei,* which, founded in 1610, qualifies as the world's first modern scientific society.

Liberal access to universities introduced in the 1970s increased enrollments from 950,000 in 1975 to 1.5 million in 1991. (See appendix table 4.) Like France, however, Italy has large numbers of students enrolled and low completion rates for formal degrees. Similar to the growth of community colleges in the United States, the highly expansive sector of Italy's higher education system is that of 3-year programs, geared to acquisition of technical skills and employment by local firms. University programs have not had the same rate of expansion, nor have the number of university teaching and research appointments expanded to educate the larger numbers of students. The number of university degree completions in all fields grew only modestly between 1975 and 1992, at less than 2 percent a year (Bussi, 1992).

[37] Information Technologies (IT); Advanced Communication Technology (RACE); Advanced Informatics in Medicine (AIM); and Industrial Technology and Advanced Materials (BRITE).

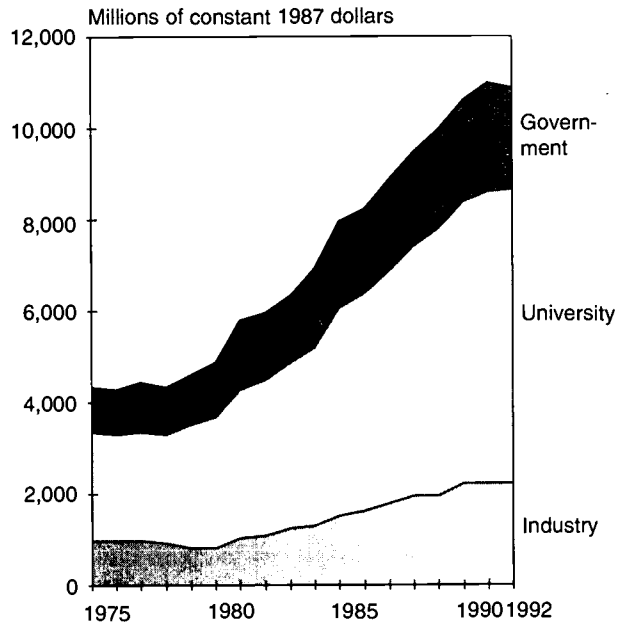
Italy's first university degree, the *laurea*, requires an average of 7 years for engineering and 5 years for literature, law, and science. The engineering curriculum has several years of basic engineering science, followed by years of specialized courses with a theoretical orientation. Few courses include industrial applications. Possibly because of the scarcity of faculty, as well as the long duration and theoretical orientation of the engineering degrees, only one-third of those studying engineering complete the program and obtain the *laurea*. The number of engineering degrees produced annually has increased only slightly in the past 17 years, from 6,900 in 1975 to 7,900 in 1992. The number of natural science degrees increased at about 1 percent per year over this time, mainly from the growing interest of women in studying scientific disciplines (Gov. of Italy, 1990). (See appendix tables 5 and 17.)

Social sciences have attracted and retained increasing numbers of university students, both men and women, in the past decade. By 1992, social science fields represented 20 percent of all first university degrees, compared with 8 percent for engineering and 14 percent for the natural sciences. (See appendix table 22.) Many of those degrees are in economics, since there is a high demand in the labor market for these skills.

Women obtain slightly less than half of the social science degrees (46 percent), but slightly more than half of the natural science degrees (55 percent) and the mathematics and computer science degrees (51 percent). (See appendix table 20.) Scientific disciplines have become attractive because women have good access to research careers in Italy. About 23 percent of the physics professors in Italy are women, compared with 3 percent in the United States. Italian women hold 20 percent of physics bachelor's degrees and 21 percent of the doctorates, compared with 15 percent and 9 percent, respectively, in the United States (AAAS, 1994a).

Italy had a 1993 GDP of $838 billion and invested approximately $10.7 billion in constant dollars, or 1.3 percent of GDP, in total R&D. (See appendix tables 9 and 14.) Industry finances 51.5 percent of total R&D, up from 41 percent in 1987. Defense R&D is approximately 10 percent of government R&D expenditures. There were 30.6 research scientists and engineers per 10,000 persons in the labor force in 1991. During the past decade, total

Figure 24. Research and development in Italy, by performer



See appendix table 10.

R&D expenditures have grown at an average annual rate of 7.5 percent in constant dollar terms. (See figure 24.) After 10 years of rapidly rising budgets, the growth of government R&D expenditures slowed briefly in 1989, followed by a return to increasing investments in R&D. Despite this heavy investment by government and industry, the goal of R&D expenditures reaching the same proportion of GDP as the other large European partners by the mid-1990s has not been achieved.

Priorities for R&D policy in Italy are directed toward increasing R&D support by government and industry, directing more funds toward new technologies and decreasing funds for nuclear R&D for electricity generation. Foci for R&D in new technologies include biotechnology and fine chemicals, information technologies, new materials, nuclear fusion, telecommunications, optics and lasers, advanced transport, satellites and space craft, and biomedical instruments. Trends in R&D policy point toward streamlined government R&D structures, new incentives for private funding of R&D, and increased European and international cooperation. Italy already invests

considerable amounts of R&D funds in international facilities, such as CERN and the ESRF, and is very active in EU and other European cooperative research programs (EC, 1994b).

Spain

The first universities in what is now Spain—Salamanca (1218) and Valladolid (1273)—predate the first universities in Germany by a century and were founded more than two centuries before the unification of the country in the late 15th century. By that time two more universities had been established: Barcelona (1450) and Saragossa (1474).

Today, institutions of higher education in Spain include the traditional university Faculties (37 public and 4 private), the newer Higher Technical Schools, and the University Schools, which were both integrated into the Spanish university system after 1970 (Casanueva de Luis, 1992). Approximately 60 percent of the students are enrolled in Faculties, 6 percent in Higher Technical Schools, and about a third in University Schools. Spain has achieved remarkable and continuous growth in university enrollments, doubling the number of students from 500,000 in 1975 to 1.3 million in 1991. (See appendix table 4.) This increased the proportion of the college-age population enrolled in higher education from 20 percent to nearly 40 percent during this same period (Gov. of Spain, 1992). (See appendix table 23.)

Engineering schools controlled admissions and did not follow the general university expansion policy to the same extent, fearing more engineers would depress pay and job prospects (Casanueva de Luis, 1992). Competition is fierce to gain entry into a school of engineering, and there is an average of about six applicants for every opening. Higher education in engineering consists of both long and short programs. The long, 6-year program, is offered in the Faculties and Higher Technical Schools and leads to the title *ingeniero superior*. The program consists of a 3-year basic scientific cycle, followed by a 3-year cycle of specialized study. Educational reforms are being discussed to shorten the second cycle of this program to 2 years to make it possible to establish equivalencies with degrees awarded elsewhere in the European Union. A short, 3-year program is offered in the University Schools, leading to a degree of technical engineer. Courses taught include engineering technology, data processing, and information technology.

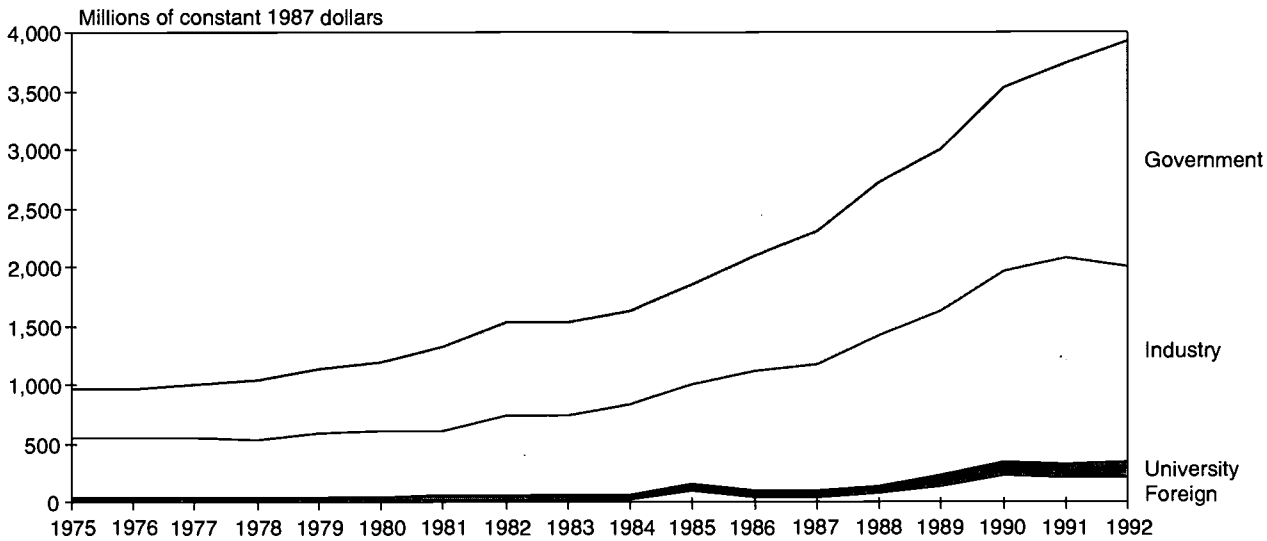
Fields other than science and engineering account for most of the growth in Spanish universities. The number of first university engineering degrees tripled between 1977 and 1991, increasing at about 7 percent a year, but overall university degrees increased at almost twice that rate, 12 percent annually. Natural science degrees grew moderately, at about 3 percent a year. Eleven percent of first university degrees are obtained in the natural sciences, 7 percent in engineering fields, similar to the proportion in these fields in U.S. higher education. (See appendix table 22.)

Women make up the majority of students and graduates in Spanish universities, but relatively few major in engineering fields. (See appendix table 21.) Still, women obtain half of the degrees in the natural sciences, and 40 percent of those in mathematics and computer science. They have begun enrolling in the Higher Technical Schools and obtained 10 percent of the engineering degrees in 1991. (See appendix table 20.)

Spain had a $413 billion 1993 GDP and invested approximately $3.6 billion in total R&D. Almost 44 percent is financed by industry. (See figure 25.) There were 24.6 research scientists and engineers per 10,000 of the labor force in 1990, half of whom work in the university. University research expenditures reached $900 million in 1993, representing one-quarter of all research performed in Spain. Total R&D expenditures increased dramatically at 11.7 percent average annual growth rate between 1983 and 1992, followed by a decrease in the past 2 years. Spain is determined to increase national R&D expenditure levels to be comparable with other advanced European countries. Spain doubled the percent of GDP invested in R&D, from 0.35 to 0.88 percent between 1975 and 1992, but would have to double this rate again to compare with other European countries.

Priority sectors for R&D include information and production technologies, natural resources and agro-industrial technologies, and quality of life. More specifically, the national R&D plan sets priorities for improving the process of innovation and technological development; conservation and optimal exploitation of

Figure 25. Research and development in Spain, by source of funds



See appendix table 11.

natural resources; strengthening the competitive capacity of industry, trade, agriculture, and fisheries; strengthening national defense; adaptation; and improving health and the quality of life (Gov. of Spain, N.D.).

The Netherlands

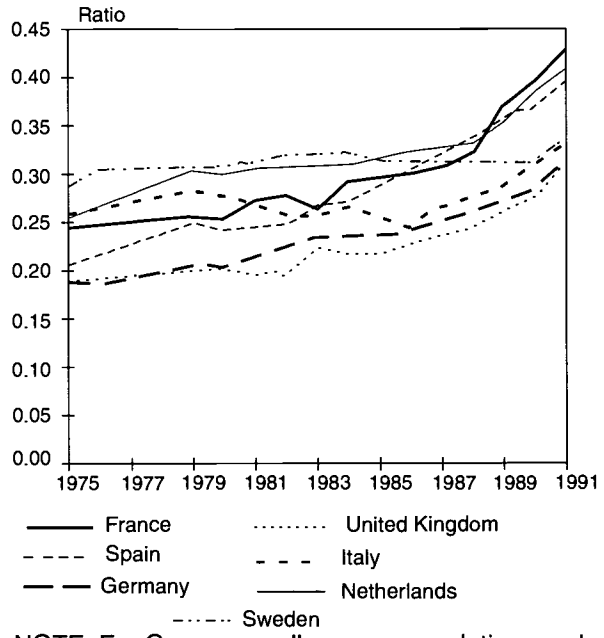
Although the first university in The Netherlands—Leiden—was not established until 1575, it soon became a notable center of European learning. Today, The Netherlands ranks first among the EU countries in growth in higher education; enrollments included 41 percent of the college-age cohort by 1991. (See figure 26.) The Netherlands, like Belgium, has a large percentage (53) of higher education enrollments in non-university institutions. (See appendix table 24.) About one-quarter of these students are taking courses part-time. Women comprise almost half of these enrollments. Programs in non-university institutions are of 4-year duration and have a higher completion rate than universities.

Until recently, traditional universities in The Netherlands, such as Erasmus University in Rotterdam, had programs taking an average of 7 years to complete,[38] similar to German universities. The University Education Act of 1982 reduced the official length (and students' financial support) for first university degrees from 5 to 4 years, but only a few percent of the students complete their courses within 4 years. Twenty percent complete a degree within 5 years. Universities have been able to reduce the average length of first university degrees to 6 years (Coppens, 1992). Recently proposed educational reforms to further reduce the first university degree to 3 years are strongly resisted by the universities (Hellemans, 1994).

First university degrees and degrees in natural sciences and engineering grew steadily from 1975 until 1988 and have declined in absolute numbers since then. (See appendix table 5.) This pattern is similar to that of the United States, with declining degrees linked to a decline in the college-age cohort. The percentages of the college-age cohort with university degrees (8.6 percent) and NS&E degrees (2.3 percent) are relatively low among

[38] Previous laws permitted unlimited sponsored study; new laws reduce years of state financial support and require full-time study.

Figure 26. Ratio of university enrollment in higher education to the 20- to 24-year-old population in selected European countries



NOTE: For Germany, college-age population used is 27 yr. olds.
See appendix table 23.

EU countries, (see appendix table 1) but many more young people obtain an associate degree.

Women enjoy almost equal access to university education, but they are underrepresented in science and engineering (Noordenbos, 1994). Women received 30 percent of the natural science degrees awarded by Dutch universities in 1991, and only 11 percent of the first university engineering degrees in that year. (See appendix table 20.) Engineering fields represented only 3 percent of first university degrees obtained by women. (See appendix table 21.)

The Netherlands had a 1993 GDP of $218 billion and invested about $4 billion or 1.8 percent of GDP in total R&D. (See appendix tables 9 and 14.) Industry finances one-half of total R&D. Most research is performed by industry (53 percent) and universities (25 percent). Defense R&D accounts for less than 2 percent of government budgeted R&D. There were 39.7 RSEs per 10,000 of the labor force in 1989. The Netherlands increased R&D investments moderately from 1975 to 1984, increased very sharply from 1984 to 1987, and maintained this level for several years, with a slight decrease in 1991.

R&D policy for The Netherlands is market oriented with the purpose of improving the competitiveness of Dutch industry. It seeks to broaden the technology base of industry and improve the quality, use, and diffusion of technology. National priorities involve the use of innovation centers, heavy investment in equipment, and the use of major incentive schemes to disseminate knowledge. A key issue in Dutch S&T policy is the internationalization of education and research.

Belgium

Since 1988, higher education has been autonomous within the Flemish and French communities of the Belgian Federation, representing approximately 60 and 40 percent, respectively, of the total population. The largest universities are the state institutions at Ghent and Liege and the French and Flemish-speaking universities at Louvain (established in 1425), Brussels, and Antwerp.

University enrollment has increased to 38 percent of the college-age cohort in Belgium, among the highest in Europe. (See appendix table 23.) Most of this growth has been in the non-university institutions; 60 percent of enrollees are in associate degree programs. Besides these short-cycle programs, there has been a great increase in 4-year programs in industrial engineering at non-university institutes, because of favorable employment prospects. These 4-year programs have a far higher retention rate than the traditional university programs of 5- to 6-year duration, from which half of the students drop out before completing a degree. The 4-year degree programs have been given the status of first university degrees, as have *Fachhochschulen* in Germany and polytechnics in the United Kingdom (Bonte, 1992).

It is difficult to describe the growth in NS&E degrees from 1975 to 1991, because of inconsistencies in the data series, possibly from incomplete submissions from the Flemish or French communities. (See Notes on Data Series.) Over the past 6 years, however, there has been a decline in the absolute number of natural science degrees

(with no decline in the college-age cohort) and a large increase in engineering degrees. (See appendix tables 5 and 6.) An explosive growth in degrees in economics, based on good employment opportunities, coincided with the decline in natural science degrees. In 1991, students obtained 26 percent of all university degrees in fields of engineering; they obtained another 28 percent in the social sciences. (See appendix table 22.)

Women in Belgium have equal access to higher education and are well represented in several fields of science. Women are 50 percent of the biology and chemistry students in the university, 35 percent of the mathematics and physics students, and 16 percent of the engineering students. (Bonte, 1992.)

Belgium, with a 1993 GDP of approximately $151 billion, invested almost $2.3 billion or 1.7 percent of GDP in R&D (more than 65 percent is funded by industry). (See appendix table 11.) Only 1 percent of total R&D is for defense. There were 44.2 RSEs per 10,000 of the labor force in 1992. Belgium has continually increased investments in R&D, more than 5 percent annually, from 1975 to 1992, in constant dollar terms. A goal is to increase R&D investment to 2.3 percent of GDP by the turn of the century.

The Deputy Prime Minister, responsible for budget and science policy, oversees S&T in Belgium. National R&D priorities are to concentrate funds on information, biotechnology, aerospace, new materials, telecommunications, and oceanography; to increase support for fundamental research and encourage more cooperation between universities and industry; to continue incentives to industry to maintain its high share of overall R&D funding; and to encourage to the maximum, participation in EC and international programs.

Denmark

The University of Copenhagen was established in 1479. Today, institutions of higher education in Denmark include both research universities in large cities and colleges throughout the country. College programs have a medium cycle (3–4 years) for teacher training, engineering, and social work, while research universities provide a long cycle (5 years). About 16 percent of the college-age cohort obtains a university education. While this percentage has not changed much in the past decade, the percentage of the college-age cohort completing degrees in natural sciences and engineering has (4.7 percent in 1991). This high rate of participation in NS&E degrees is second only to Germany among Western European countries. Fields of engineering have become some of the most popular majors in the university in Denmark (Traberg and Bache, 1992). In 1991, 21 percent of all university degrees were in engineering, 8 percent in the natural sciences, and 5 percent in the social sciences. (See appendix table 22.) Doctoral degrees, usually pursued as part of a research career, increased greatly after 1987, numbering 416 in 1991. More than 60 percent of these degrees were in science and engineering.

More women than men receive a university education in Denmark: 18 percent of the female college-age population obtained a university degree in 1991; 14 percent of males obtained such a degree. (See appendix table 25.) Women are relatively well represented in engineering departments and earned 19 percent of first university degrees in engineering in 1991. (See appendix table 20.)

Denmark, with a 1993 GDP of about $78 billion, applied approximately $1.4 billion or 1.7 percent of GDP to R&D, with 51 percent of that amount coming from industry. (See appendix tables 9 and 10.) There were 41.4 RSEs per 10,000 of the labor force in 1991. During the past 12 years, total R&D expenditures have grown 6.7 percent per year in constant dollar terms, with the business sector R&D contributing most of this growth. A national goal is 2.3 percent of GDP expended for R&D by the year 2000. Maintaining the same rate of increase in R&D until the year 2000 would allow that R&D goal to be reached.

The Ministry of Education and Research and the Ministry of Industry are responsible for S&T in Denmark. Science and technology are priority areas for national policy, and research is supported in strategic areas of industrial and societal needs. Industrial research focuses on drugs and medicine, machinery, and small enterprises. The six high-priority areas in the public sector include biotechnology, environmental research, information technology, cancer research, materials research, and health and nutrition (Gov. of Denmark, 1993a). The government is fostering knowledge-intensive industries in science parks and making special efforts to disseminate public sector

research results to Denmark's predominantly small- and medium-sized enterprises (Gov. of Denmark, 1993b).

Ireland

Ireland has doubled higher education enrollments since 1975, reaching more than 100,000 students by 1991. A little more than half of these enrollments are in traditional universities, such as the University of Dublin and Trinity College, both founded in 1592, and the National University, founded in 1909, with constituent colleges in Dublin, Galway, Cork, and Maynooth. Almost half the students are enrolled in non-university institutions, including nine regional technical colleges, a National Institute for Higher Education in Limerick, and five teacher-training colleges.

Following this enrollment pattern, Irish universities doubled the annual number of degrees they conferred in all fields between 1975 and 1991. This increase in first university degrees represented an average annual growth rate of 5.8 percent. NS&E degrees grew even faster, shifting the share of S&E degrees in the university from 31 to 35 percent. (See appendix table 22.) The number of NS&E degrees conferred annually tripled from 1975 to 1991, representing a 6.4-percent annual increase in natural science degrees, and a 7.1-percent increase in engineering degrees. Ireland's research universities provide particularly strong training in biotechnology. Ireland has acquired an ability to contribute to and receive funding from the EU Framework Program in life sciences and technology, and from EUREKA projects in biotechnology in collaboration with other European countries (EC, 1994b).

Men and women in Ireland have equal access to university education, but the male college-age cohort has twice the participation rate in NS&E degrees as the female: 6 and 3 percent, respectively. (See appendix table 25.) Women received half of the natural science degrees in 1991, 61 percent of the social science degrees, but only 13 percent of the engineering degrees that year. (See appendix table 20.)

Ireland, with a 1993 GDP of $35.7 billion, spent approximately $422 million or 1.1 percent of GDP on total R&D. Industry increased its share of R&D funding to 65 percent in 1992, up from 50 percent in 1988. (See appendix tables 9 and 11.) There were 57.6 RSEs per 10,000 of the labor force in 1991. There were modest increases in total R&D from 1975 to 1983, with continually high rates of growth since then (almost 10 percent annually). International sources of funding provided 10 percent of R&D support by 1992, particularly from EU and EUREKA schemes that encourage industrial partnerships.

The Ministry of Science and Technology operating within the Department of Industry and Commerce is responsible for S&T policy in Ireland. All R&D expenditures in Ireland are for civil research. Strategic national priorities for R&D emphasize application-oriented research in biotechnology, engineering, advanced materials, and information technology. S&T expenditures have declined in agriculture and energy sectors and increased in the manufacturing sector.

Greece

The University of Athens, founded in 1836, is the oldest of the 17 university-level institutions in Greece. The National Technical University of Athens, the foremost school of engineering and a major research institution, provides a 5-year program for the first university degree (*Ptychion*). Rapid industrialization in Greece in the 1960s and early 1970s dramatically increased the demand for education, particularly at the tertiary level. The government sets quotas for new entrants to universities, but they are far below the social demand for higher education. Only 25 percent of the college-age cohort is enrolled in higher education in Greece, the lowest percentage in the EU. (See appendix table 23.)

The solution for this unmet demand for higher education has been study abroad. Greece has the second largest percentage of students studying abroad, surpassed only by Luxembourg, which has no university-level institutions. Students not admitted to universities in Greece tend to study in Italy, Germany, France, and the United Kingdom. These countries have policies of no higher tuition costs for students from other EU member countries (Sianou, 1991). In addition, students from Greece obtain more S&E doctoral degrees from U.S. universities than students from any other European country (NSF, 1993b).

More women than men obtain a university degree in Greece, but this may reflect more male students studying abroad. (See appendix table 25.) Women receive 43 percent of the natural science degrees, 51 percent of the social science degrees, and 23 percent of the engineering degrees. (See appendix table 20.) This high representation of women in engineering majors may also be a consequence of more males going abroad to study engineering.

Greece, with a 1993 GDP of $67.5 billion, expended approximately $287 million or 0.45 percent of GDP on total R&D. Defense R&D is 5.5 percent of total government R&D. (See appendix table 9.) RSEs reached 15.4 per 10,000 of the labor force in 1991. (See appendix table 12.) R&D investments grew rapidly in the 1980s, 15 percent annually from a low base, and have leveled off in the 1990s. Foreign sources of funding reached a significant proportion (19 percent) of total R&D in 1992. (See appendix table 11.) Greece is benefiting from EU and EUREKA programs to increase geographic equity in R&D and raise the level of scientific research and industrial competitiveness throughout poorer countries in Europe. Unlike Ireland, however, Greek industry has not funded the majority of R&D investments. Greek industry has slightly decreased its typical contribution of 25 percent of overall R&D funding to 22 percent in 1992.

National R&D priorities are to establish the institutional infrastructure for S&T development, enhance the quality of S&T outputs, exploit R&D results, assimilate important technologies, and improve public opinion about the importance of R&D for economic and social development. Areas targeted for special emphasis include social and human sciences, information technology, biotechnology, and development of industrial research.

Portugal

Universities established in Portugal prior to the end of the 15th century include Lisbon (1288) and Coimbra (1290). Portugal has greatly expanded and diversified its higher education system, mainly in the coastal district in Lisbon, Porto, Coimbra, and Aveiro. The number of universities offering the *Licenciado* degree, (5- to 6-year program) has substantially increased, now numbering 14 public and 6 private institutions. After 1977, new private polytechnic institutions were established to provide professional skills demanded by economic development and now number 14 public and 35 private institutions. This rapid expansion of higher education was fed by the ballooning of upper-secondary-school completions, from 15 percent in the 1960s to 65 percent in 1989 (Valdares, 1992).

While the percentage of the college-age cohort enrolled in higher education has increased from 11 to 23 from 1975 to 1991, Portugal has the lowest participation rate in higher education of EU countries, except for Greece. In most EU countries, 30 to 40 percent of the college-age cohort is enrolled in higher education. (See appendix table 23.) Portugal would like to reach EU enrollment levels as well as degree completions. Currently, between 6 and 7 percent of the college-age population obtains a university degree, and less than 2 percent receive NS&E degrees, the lowest rate in the EU. (See appendix table 1.) Portugal would like to double this, through expansion of polytechnics for employment-oriented coursework (as Germany has done), not through expansion of traditional universities.

The participation rates in science and engineering, while low, are almost equal for men and women in Portugal. Women dominate in the natural sciences; more women than men major in the natural sciences (69 percent). More men than women major in engineering (70 percent). (See appendix table 20.) Portuguese government statistics show that, during the 1980s, 50 percent of the Ph.D.s in mathematics, physics, chemistry, and biology were awarded to women (AAAS, 1994a).

Portugal had a 1993 GDP of $74 billion and allocated approximately $536 million, or 0.75 percent, of GDP to total R&D. (See appendix tables 9 and 14.) Portugal has invested very steadily in R&D since 1975, at an average annual increase of 12 percent, but from a low base. RSEs increased to 12.4 per 10,000 persons in the labor force during this time. The Government of Portugal still provides the majority of funding for R&D investments (60 percent in 1992). (See appendix table 11.) Industry funds 20 percent of total R&D, and foreign funding, which would imply participation in EU and EUREKA programs, provides approximately 15 percent. The EU promotes collaboration between the most advanced European

countries and the less developed countries such as Greece, Portugal, and Ireland, to increase geographic equity in research capabilities.

New investments in R&D are expected to materialize as a result of the recent establishment of a Ministry of Science. National priorities for R&D include programs for applied research directed to end users, strengthening basic research in universities, promoting mobility in science, and developing joint programs between research institutions and industry. A major priority is to strengthen S&T infrastructure as well as education of S&T researchers. Key areas for research programs are biotechnology, robotics/microelectronics, materials science, and marine science. A national goal has been to steadily increase the resources committed to R&D.

Sweden

The oldest and largest university in Sweden is in Uppsala and dates from 1477. Other major universities established since the 17th century are in Lund, Göteborg, Stockholm, Umeå, and Linköping. Specialized institutes of higher education and research include the Karolinska Institute (medicine), the Royal Institute of Technology, Chalmers Institute of Technology, Luleå University College and Institute of Technology, the Stockholm School of Economics, and Stockholm Institute of Education. Most higher education institutions are run by the central government; university faculty are national civil servants. The higher education reforms of 1991 and 1993 aim to deregulate the higher education system, giving institutions greater autonomy and allocating grants between institutions based on achievements (The Swedish Institute, 1994).

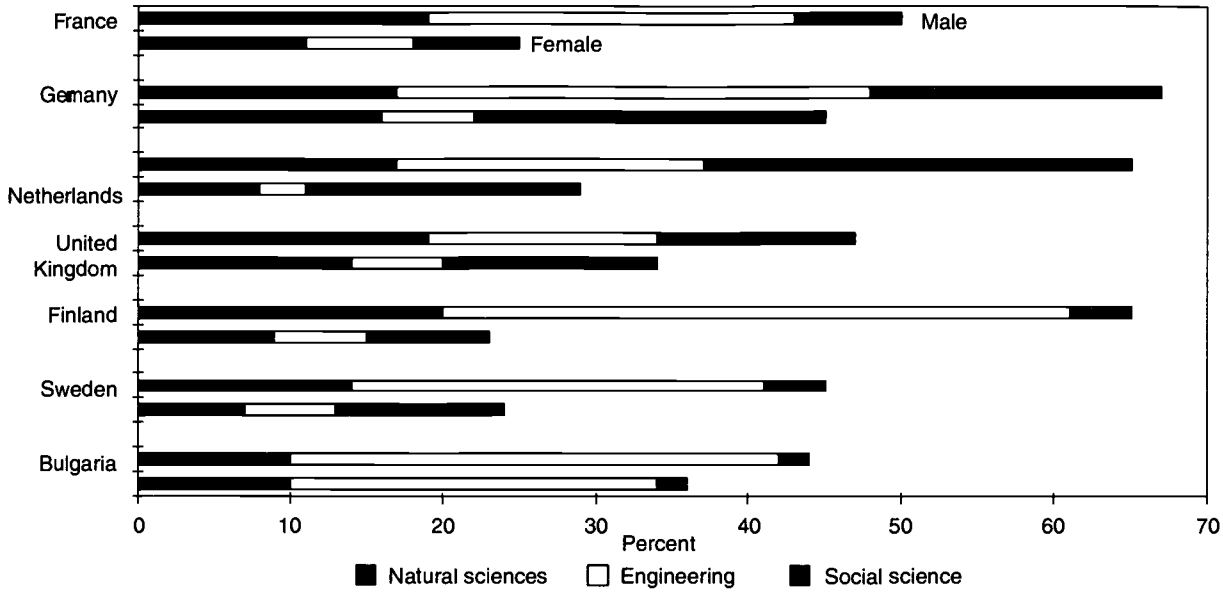
The number of admissions to higher education in Sweden grew dramatically in the 1960s, remained constant in the 1970s and 1980s, and again grew rapidly after 1991. Therefore, the educational statistics have changed little during the 17-year time series used in this report. The data for 1975 to 1991 show that there have been relatively small increases in enrollment in higher education, from 162,000 in 1975 to 207,000 in 1991, only a 1.5-percent annual increase. Similarly, the number of first university degrees has increased by only 1 percent per year during the 1975 to 1991 period (Gov. of Sweden, 1993). Therefore, the percentage of college-age students with university degrees has remained relatively constant, at about 13 percent during this time period. (See appendix table 7.) By 1994, however, university enrollments were 25 percent higher than in 1991.

University admissions remain very competitive, even though the college-age cohort is dwindling. Many more students are taking the 4-year college track in upper secondary school, rather than the 2-year vocational curricula. Better prepared students are competing for a fixed number of places. Work experience gives additional credits with which to compete for admission to attractive disciplines. The proportion of first time enrollees returning to the education system after years of working has grown since the 1960s. This has substantially broadened the age distribution of first year students at colleges and universities. About 60 percent are older than 25 years old. The age segment used for the college-age cohort in Sweden in this report is 25 to 29 (Forneng and Andersson, 1992).

The only change in higher education statistics shown by the available data (1975 to 1991) has been the shift toward more degrees in science and engineering in the 1980s. Admission quotas to universities and particular disciplines are controlled by the *Riksdag* (parliament), which increased the number of S&E admissions by 50 percent when Sweden's economic boom of the early 1980s created a demand for scientists and engineers. NS&E degrees grew from 2,400 in 1982 to 4,000 in 1991, representing more than a 6-percent average annual increase. (See appendix table 5.) The percentage of college-age students with NS&E degrees grew from 2.1 to 3.4 percent during this time. (See appendix table 8.) Future demands on the higher education system for more engineers, biologists, chemists, and economists are expected, as the service sector expands and manufacturing trades decline.

In Sweden, more women than men receive a university education, but only a small percentage of total female university degrees are earned in fields of science or engineering fields compared with other European countries. (See figure 27.) Fifteen percent of the female college-age cohort obtained a university degree in some field in 1991, while only 11 percent of males obtained such a degree. This imbalance partly results from the

Figure 27. Science and engineering degrees as a percentage of all first university degrees in selected countries, by sex: 1992

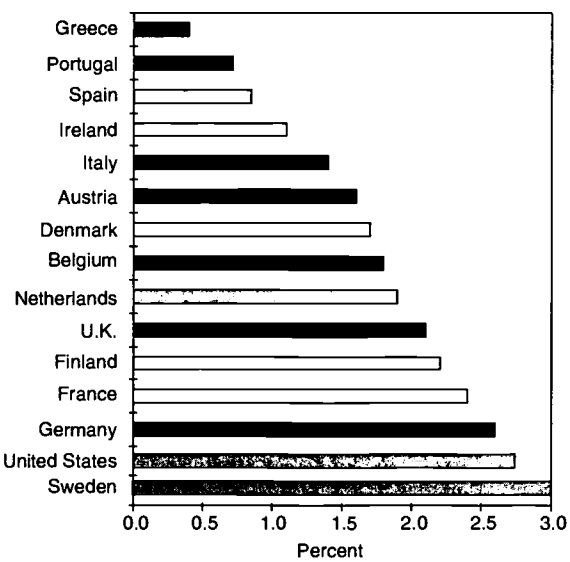


See appendix table 21.

Educational Reform Acts of 1977, in which all forms of post-secondary education, including highly vocational fields, such as nursing and pre-school teacher training, were incorporated into higher education and administered by the university. Women obtain the vast majority of these degrees. The share of S&E degrees received by women is also quite high. In 1991, they received 54 percent of the natural science degrees, 30 percent of the mathematics and computer science degrees, 78 percent of social science degrees, and 21 percent of all engineering degrees.

Sweden invested heavily in science and knowledge industries during the economic boom of the 1980s. From 1988 to the present, however, growth in R&D expenditures in Sweden has been slower. With a 1993 GDP of $121 billion, Sweden invested approximately 3.8 billion or 3.1 percent of GDP in R&D, the highest in Europe and also in the world. (See figure 28.) From 1975 to 1988, Sweden increased investments in R&D by 6 percent annually; from 1988 to 1993, R&D investments grew at less than 1 percent. Swedish industry heavily funded R&D throughout this period, reaching 61 percent of total R&D in 1992. Industry's increasing R&D

Figure 28. Percent of gross domestic product in research and development in European Union countries and the United States: 1992



See appendix tables 9 and 14.

expenditures, particularly in telecommunications equipment and pharmaceuticals, offset the recent slight decline in government R&D expenditures. This investment in research has increased RSEs per 10,000 persons in the labor force from 36 in 1975 to 56 in 1991. (See appendix tables 11, 12, and 14.)

Finland

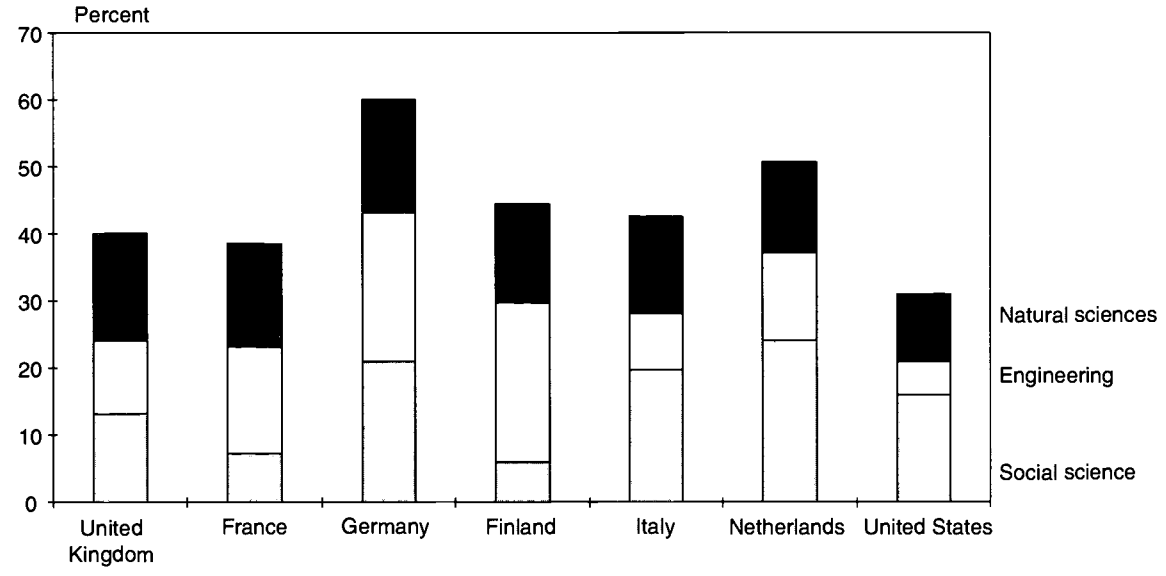
Finland's sparse population of 5 million is one of the most educated in the world.[39] Half of the college-age cohort in Finland is enrolled in higher education—the highest ratio in Europe. (See appendix table 23.) Finland's 20 institutions of higher education are mainly in the southern temperate region of the country, including the University of Helsinki, established in 1640, three in Turku, the oldest university town, and two in Tampere. Of these, Helsinki is by far the largest, educating one-quarter of all university students. Newer universities have been established in the North, Central, and West coast of Finland.

[39] Finnish children start their first foreign language in third grade, their second foreign language in seventh grade, and their third foreign language in eighth grade.

Finland has a restricted definition of university education and has not incorporated professional education into the university system. Students undergo intense competition for admission because of a restricted number of places in all fields. The first university degree in Finland requires an average of 5 to 7 years for completion. Two-thirds of the students in higher education are enrolled in such programs. One-third of the students in higher education in Finland enroll in shorter programs in vocational institutions, now numbering around 682, and offering 3- to 5-year programs. Vocational education is offered in electrical, mechanical, and chemical engineering and in 22 other branches of learning to prepare students to enter working life directly or to enter advanced training. The level and breadth of Finnish vocational curricula may compare favorably with the undergraduate-level curricula in other countries (Hopkins, 1990).

The data reported here, for formal university programs only, show that overall university degrees increased moderately between 1975 to 1991, growing at an annual rate of 1.6 percent. Natural science and social science degrees awarded annually have declined slightly in absolute numbers during this period, while the number

Figure 29. Percent of science and engineering degrees among total first university degrees in selected European countries and the United States: 1992



See Appendix table 2.

community colleges. Three year, vocationally oriented programs in higher education were a priority of Norway's labor sector.

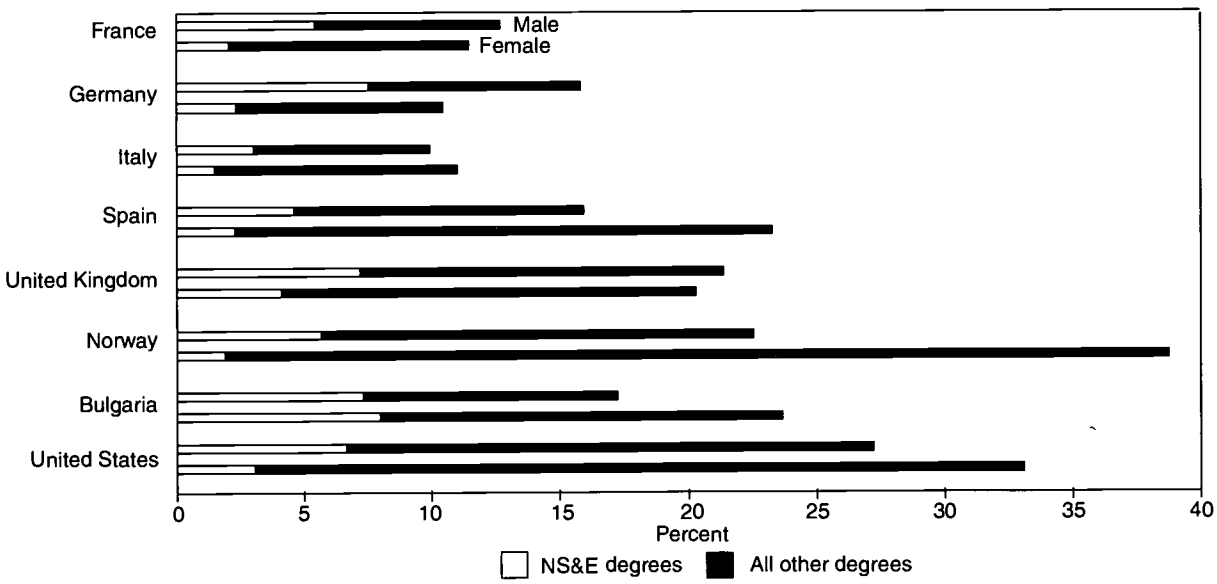
The trend in Norway is toward an aging student population; the mean age of first year entrants is 23, with a slow study progression in most fields. Only in engineering do students complete studies in the prescribed time. The average age of the first university degree in the sciences is 28. Engineering and computer sciences in the university sector require 4 to 5 years of study. The natural and social sciences require 3 years for a lower degree, with 2 additional years for a higher degree (master's). In the sciences, higher degrees are much more common; three times as many students obtain higher degrees than lower degrees in these fields (Naess and Aamodt, 1992).

Norway more than doubled enrollment in higher education between 1975 and 1991, from approximately 67,000 to 166,000 students. By 1992, 49 percent of the college-age population was enrolled in some form of higher education. A significant amount of this growth is to study business administration in newly formed private institutions, to try to fill the demand for these skills in the labor market. Only about 40 percent of the enrollments in higher education are in the traditional university sector. The majority, 60 percent, are in regional and specialized colleges upgraded to higher education institutions after 1970.

A high fraction (30 percent) of Norwegian young people obtain a university education, comparable with the United States, but relatively few students major in science. (See appendix tables 1 and 22.) Only about 2.5 percent of university degrees are in fields of natural science. Engineering degrees, however, quadrupled from 1976 to 1987 in response to the demand created by the discovery of North Sea oil and now make up 10 percent of all university degrees.

More women in Norway complete a higher education degree than men, but fewer women earn their degrees in the sciences. Thirty-eight percent of the female college-age cohort obtain a first university degree, while only 22 percent of men obtain such a degree. (See figure 30.) The likely reason for this disparity is that teaching and nursing schools, predominantly female, were incorporated into university education. Men major in science and engineering far more than women; 5.7 percent of the male

Figure 30. Percentage of college age cohort with first university and natural science and engineering degrees, by sex: 1992



NOTE: Uses 27-year-old population for Germany.
See appendix table 25.

of engineering degrees received annually has tripled. Almost one-quarter of total university degrees obtained in 1991 were in fields of engineering. (See figure 29.) Since Finland's college-age population declined between 1975 and 1995, this attraction to engineering degrees has resulted in a high participation rate in technical degrees. More than 6 percent of the college-age cohort obtains a university degree in science or engineering, the highest percentage in Western Europe. When this is disaggregated for men and women, the data show that 10 percent of young Finnish men obtain an NS&E degree and 2.8 percent of young Finnish women obtain such a degree. Women receive the majority of natural and social science degrees at the university level, but only 13 percent of the engineering degrees.

Finland, with a 1993 GDP of $621 billion, invested approximately $1.4 billion or 2.2 percent of GDP on total R&D. Industry funded more than 60 percent of R&D in the late 1980s, but has cut back funding somewhat in 1990–1993. The number of RSEs more than doubled, from 6,000 to 14,000 between 1975 and 1991, reaching 54 per 10,000 of the labor force by 1991. Finland maintained high growth in R&D investments, while the economy grew in the 1980s, and has been able to increase R&D spending in the 1990s even while the GDP declined 4.6 percent in the 1990–1993 period. This required increased government funding, particularly in the past 2 years, to offset the decline in industrial support of R&D. (See appendix tables 9, 11, and 14.)

Austria

The University of Vienna was established in 1365. Austria is one of the few European countries that has not developed associate-level degrees or short-cycle programs of higher education with a practical orientation. While enrollments doubled in the period from 1975 to 1991, the vast majority of them (93 percent) are in full university degree programs. Thirty-five percent of the college-age population were enrolled in universities in 1991, up from 19 percent in 1975 (Lassnigg, Loudon, and Spreitzer, 1992).

First university degrees in all fields doubled in the past 16 years, from around 4,000 in 1975 to more than 10,000 in 1991, representing an average annual increase of 6 percent. Degrees in S&E fields grew at a similar rate so that their proportion of total degrees remained relatively constant over this period. About one-quarter of all university degrees are obtained in natural sciences and engineering; another 6 percent are in the social sciences. Participation rates in S&E degrees doubled in this period, but from a low base: less than 10 percent (men or women) of Austria's college-age cohort receive a university degree. While women have almost equal access to university education, less than 1 percent of college-age women obtain their degrees in natural sciences or engineering. Women are especially underrepresented in engineering. They obtained only 7 percent of the 1,000 engineering degrees awarded in Austrian universities in 1991. (See appendix table 20.)

Austria, with a 1993 GDP of $118 billion, invested approximately $1.9 billion or 1.6 percent of GDP in R&D. Industry finances about one-half of total R&D in Austria. Defense R&D comprises 1 percent of government expenditures for R&D. There are 24 RSEs per 10,000 persons in the labor force. R&D investments in Austria have risen 6 percent annually for 18 consecutive years, from 1975 to 1993. These R&D increases are being sustained even with a decrease in economic growth.

European Free Trade Association

Until recently, Norway, Sweden, Finland, Austria, Iceland, and Switzerland made up the countries of the EFTA. Three of these countries—Austria, Finland, and Sweden—have voted, in national referenda, in favor of joining the EU. These decisions were ratified by their respective parliaments in early 1995.

Norway

Norway has two sectors in its higher education system: the university sector consisting of 4 universities and 10 university-level colleges, and the non-university sector which contains 98 colleges. The latter include specialized colleges for fields such as nursing, teacher training, and engineering. These were upgraded to higher education institutions after 1970 and reorganized into 26 units in 1994. Great expansion has taken place in the non-university sector, as has occurred in the United States in

college-age cohort obtains a natural science or engineering degree, while less than 2 percent of college-age females obtain such degrees. Women do, however, obtain a relatively high share (22 percent) of engineering degrees and a third of the natural science degrees in Norway (Stiver Lie and Teigen, 1994).

Norway's economy suffered a severe slump in the 1980s until the North Sea oil discovery could be exploited. GDP has shown positive growth since 1988. In 1993, with a GDP of $62.9 billion, Norway invested $1.2 billion or 1.9 percent of GDP in R&D. Industry's share of R&D funding reached as high as 50 percent in 1987, but has since declined to 44 percent in 1993. R&D investments increased rapidly in the 1980s, leveled off in 1989 to 1991, and increased towards 1993.[40] International sources of funding reached 5 percent in 1993.

Norway has singled out certain priority areas for research. These include information technology; biotechnology; new materials; aqua culture; offshore oil and gas technology and related research, management, organization, and administrative systems; health, environment, and social issues; and research related to the dissemination of tradition and culture (EC, 1994b).

Switzerland

Two federal institutes of technology, in Zurich and Lausanne, and seven cantonal[41] universities, accommodate the relatively small portion of the population that goes on to a post-secondary education in Switzerland. Only 13 percent of high school students receive the education and pass examinations necessary for the university. Seven out of ten students go to a high school with an apprenticeship program. As in the United States, there is no national system; each Canton is responsible for financing its higher education system (Ogay, 1992).

Swiss are conservative in their definition of first university degrees. There are no professional schools within universities. Professional education and training occurs in non-university higher education for teacher training, engineers, public administration, social work, and education specialists. Switzerland does not include graduates from these specialized schools in university counts as other countries have begun to do. Partly because of this restrictive definition of universities, Switzerland ranks near the bottom of Organisation for Economic Co-operation and Development countries in the percentage of its college-age cohort who obtain a university degree—8.3 percent. (See appendix table 1.) If non-university higher education was included, that figure would be 14 percent, similar to many European countries (Gov. of Switzerland, 1993).

There are two routes for engineering education: engineering studies in polytechnics, which are the university-level Federal institutes of technology, and the higher technical schools. Access to the formal higher education institutes are reserved for those who have completed the pre-university track in secondary school. In the polytechnics, students learn engineering concepts and basic sciences and are prepared to engage in fundamental research. Admission to the higher technical schools requires a certificate of professional formation in industry or in a trade school. Students receive a 3-year practical education in mechanical, electrical, civil, or construction engineering. Two to three times more students receive engineering degrees from higher technical schools than from the university level (Lambrech, 1993).

Traditionally, Swiss university students have preferred non-technical majors. In 1992, only 8 percent of first university degrees were obtained in fields of engineering, similar to the percentage for engineering in the United States. Since 1985, the annual growth rate in numbers of S&E degrees has increased slightly faster than overall university degrees. Most fields of science and engineering grew between 4 and 6 percent. Mathematics and computer science degrees grew at more than 11 percent annually, but from a small base. Overall university degrees grew at 3.8 percent during this same time. Only 2 percent of the college-age cohort obtains a university degree in natural sciences or engineering. (See appendix table 1.)

[40] The EU's Fourth Framework Program is included in the European Economic Area (EEA) Agreement among 17 European countries. Thus, although Norway elected to remain outside the European Union, as a member of the EEA, the country will be a full participant in the EU's joint research programs (Gov. of Norway, 1995).

[41] A canton is a territorial division, or state, of Switzerland.

Women make up 30 percent of university enrollments in Switzerland. They obtain half of the social science degrees, and one-quarter of the natural science degrees, but only 3 percent of the university engineering degrees. (See appendix table 20.)

Switzerland, with a 1993 GDP of $125 billion, invested $3.3 billion or 2.6 percent of GDP in R&D. R&D investment grew sharply from 1983 to 1990 and leveled off when the GDP growth leveled off in 1991. RSEs rose from 10,000 in 1975 to 17,000 in 1991, representing 45 RSEs per 10,000 of the labor force in 1991.

Central and Eastern Europe

It is expected that the EU will expand to include several countries of Central and Eastern Europe in the early 21st century. Poland and Hungary have already applied for formal admission. The prime ministers of these two countries, as well as those from the Czech Republic, Slovakia, Romania, and Bulgaria, participated in the 1994 summit in Essen, Germany, to discuss the Union's future course.

The Czech Republic has a well-developed university system, including Charles University in Prague (1348), the oldest university in Central Europe, as well as the Czech University of Technology (1717), the first school of Engineering in Central Europe. The Czech higher education system offers no associate-level degrees, and university programs are of 4 to 5 years' duration (Umehara, 1990). Within these programs, engineering is one of the most popular degrees. In 1992, more than one-third of all university degrees were obtained in fields of engineering. The people in the Czech Republic have relatively high access to university education; more than 12 percent of the college-age cohort obtained a university diploma in 1992, and almost 6 percent of this cohort obtained their degree in natural sciences or engineering.

The Czech Academy of Sciences and Arts (founded in 1888) managed basic research under the direction of the Communist Party from 1949 to 1989. Research was conducted in scientific institutes, over a hundred of which were located in Prague. In 1992, the Czech Academy was reformed and a competitive grants program—the Czech Grant Agency—was established. The Ministry for Education, Youth, and Sports has been given responsibility for coordination of overall science policy. The Czech Republic is attempting to integrate the scientific community, in Academy institutes and universities, into the larger European community, even before political and economic integration is realized.[42]

Higher education in Slovakia (former eastern section of Czechoslovakia) had been neglected until the 20th century. Slovakia's Comenius University, its first, was established in 1919. The main focus of the university is on engineering. Over 40 percent of the university degrees are in fields of engineering, similar to China. Because of this technical focus, the participation rate in NS&E degrees is quite high—7.4 percent.

Hungarian universities were first established by the church in the 14th and 15th centuries. The Hungarian higher education system adopted the German model, but the hierarchical social system confined higher education to the elite. Hungary has 4 universities (Budapest, Pécs, Szeged, and Debrecen), 14 specialized universities, and 36 institutes (Academic American Encyclopedia, 1994a). Less than 10 percent of the college-age cohort obtain a university education, and among this small group, relatively few study natural sciences or engineering.

Hungary has a network of 52 research institutes of the Academy of Sciences, which support basic research. University researchers may now apply for funding to the Hungarian Science Foundation. Hungary had approximately 30,000 RSEs in 1990, 20 percent fewer than in 1985 (HAS, 1991). Scientists in Hungary, as in other Central European countries, are emigrating to the West because of extremely low salaries. Priorities in scientific research include basic research in materials science, biological basic research and biotechnology, computerization, telecommunications, automation facilities, information systems, and research on environmental protection.

The first Polish university, Jagellonian University in Cracow, was established in the Middle Ages (1364) to

[42] For example, foreign reviewers are included in peer review of proposals to the Czech Grant Agency. In addition, evaluation committees, consisting of the best scientists from abroad and from the university community, have rigorously reviewed Academy institutes and reduced their overall number from 82 in 1989 to 60 in 1994 (NSF, 1994b.)

train clergy. In the past 50 years, Polish universities developed a strong concentration in the natural sciences and engineering, following the Russian model. This concentration, particularly in engineering, has gradually lessened in the more open political climate of the 1990s. Natural science degrees declined from 15 to 12 percent of total degrees from 1989 to 1992; engineering degrees declined from 19 to 13 percent of total degrees. During this same time period, the number of social science degrees sharply increased, but from a small base (Gov. of Poland, 1993).

The S&T policy of the Polish government is to stimulate science areas that will benefit the country's economy (Business Foundation, 1993). Those areas include expansion of electronics in the national economy, automation and robotics for manufacturing processes, nuclear energetics and technology, new materials, biotechnology, food management, and environmental protection. Poland's S&T policy is to strengthen support of small innovative enterprises, which supply pharmaceuticals, electronic medical equipment, new materials, and other modern products.

Some Eastern European countries adopted the former Soviet model of higher education, which emphasized science and engineering and an engineering curricula that focused on training for production. In Bulgaria, for example, the fields of natural sciences and engineering were given the highest priority for enrollment quotas and generally a 50:50 ratio of male and female students. In addition, prospective students were screened on straightforward criteria: competitive examinations and mathematics competence. (Acceptance into humanities, arts, and drama relied more on party affiliation, interviews, and being deemed suitable to the regime.) Students flocked to higher education and to mathematics, science, and engineering in particular. University enrollments increased even more sharply in post-totalitarian Bulgaria in the 1990s. In 1992, 20.2 percent of the college-age cohort received a university degree; 7.6 percent in fields of natural sciences or engineering. (See appendix table 1.)

The participation rate for women in these fields is slightly higher than for men: 7.8 percent of the female college-age cohort obtained an NS&E degree in Bulgaria in 1992; 7.2 percent of males in this age group obtained such a degree in that same year. Considerably more women than men obtain a university education: 23.7 percent of the female college-age cohort obtained a university degree in 1992; 16.9 percent of college-age men obtained such a degree that same year. (See appendix table 25.) In 1992, women obtained 57 percent of all university degrees. In addition, they obtained half of the engineering degrees, 70 percent of the natural science degrees, and 73 percent of the mathematics and computer science degrees. These percentages have not changed since 1975 (Stretenova, 1994). (See text table 12.)

Text table 12. Percent of first university science and engineering degrees earned by men and women in selected European countries: 1992

Country and field	Men	Women
Ireland		
Natural sciences	50	50
Social science	39	61
Engineering	87	13
Italy		
Natural sciences	46	54
Social science	54	46
Engineering	92	8
Portugal		
Natural sciences	31	69
Social science	37	63
Engineering	70	30
Sweden		
Natural sciences	46	54
Social science	22	78
Engineering	79	21
Bulgaria		
Natural sciences	30	70
Social science	44	56
Engineering	51	49
Czech Republic		
Natural sciences	45	55
Social science	32	68
Engineering	78	22
Slovac Republic		
Natural sciences	38	62
Social science	24	76
Engineering	70	30

See appendix table 20.

Romanian universities were also greatly influenced by the former USSR, and most higher education degrees were given in technical fields. In 1992, more than half of all first university degrees granted in Romania were in engineering. Substantial changes have been made in the 1990s, however, in elimination of Marxist coursework and a drastic reduction in social science degrees awarded. Current educational reforms are developing criteria and standards for academic evaluation of both State and private universities, with the help of the UNESCO European Center for Higher Education. Participation rates in university education in Romania remain low; in 1992, only 7 percent of the college-age cohort obtained a university degree. Since these degrees are quite focused on natural sciences and engineering, however, the participation rate of Romanian young people in NS&E degrees is high—more than 5 percent.

Prospects for the Future

The integration of European Union (EU) economies into a single market of more than 360 million people is expected to create conditions for more growth in the future. In addition, European governments are in the process of restructuring their economies to increase their competitiveness in global markets, a process begun in the United States in the late 1980s. As trade barriers around the world are falling and as Asian and Latin American economies are developing and integrating into the world marketplace, European countries face increasing pressures. Companies are downsizing, and governments are selling state-owned industry to the private sector to increase their efficiency. The United Kingdom led in this privatizing effort. The French government sold Elf-Aquitaine to private investors and Germany plans to do likewise with Deutsche Telekom. Europe's economic integration is encouraging this privatization by adapting pro-competition rules and discouraging subsidies to state-owned industries. The value of sales of such national industries to the private sector, begun in the 1990s, is estimated by the European Economic Research and Advisory Consortium to reach $100 to $150 billion by 1998.

Research and development (R&D) expenditures in Europe are not expected to increase, in the near term, as rapidly as they did in the 1980s (EC,1994b). Several European countries, such as France, the United Kingdom, and Germany, which increased R&D rapidly throughout the 1980s, now need to manage tight public science budgets while reorienting programs to contribute to wealth creation. Defense R&D is expected to continue to decline in the United Kingdom and in France, based on their proposed science budgets (EC, 1994b). However, in the long term, if Europe can achieve better economic growth through unification and integration of the research base, R&D expenditures will probably increase again.[43] The EU will continue to work on the integration of European research. It will be helped in this effort by the new advisory panel, the European Science and Technology Assembly (ESTA), consisting of 100 members nominated by the European Science Foundation and the Association of All European Academies. Through ESTA, scientists will help to shape the EU research budget and also oversee the commission's methods of peer review of proposed projects.

The EU Framework Program will also continue to work for increased mobility and the improvement of the international education of science and engineering (S&E) students for the future workforce throughout Europe. Many European postdocs are receiving funding to spend several years working in another country. EU follow-on activities to ERASMUS for student and teacher mobility will be under the new SOCRATES Program, and LEONARDO will support a Community vocational training program (AAAS, 1994b). The EU will also provide funding for trans-Atlantic links to exchange students and teachers between EU and U.S. universities (EC, 1992; AAAS, 1994b). The current employment of non-nationals, many of whom come from outside Europe, represent less than 10 percent of the total stock of scientists and engineers in non-university research laboratories. This proportion is expected to grow in the future (Healey, 1994a).

The successor program, SOCRATES, for 1995–1999, is funded for $800 million to support 700,000 undergraduate student exchanges. As the successor to the Human Capital and Mobility Program, the new Framework Program for Training and Mobility of Researchers, is funded for $700 million to support the exchange of 7,000 postdoctoral researchers.

[43] The Organisation for Economic Co-operation and Development's (OECD) latest projections of real gross domestic product growth for EU countries are quite positive (OECD, *OECD Economic Outlook 57*, Paris, 1995).

It is likely that the integration of science and technology in Europe, through increased mobility and international collaboration among EU scientists, will *encourage* rather than diminish collaboration with the United States. For example, Germany is promoting U.S.–German graduate student exchanges at the University of Aachen and is fostering an international engineering community by encouraging companies from the United States, Canada, and Japan to join their industrial science park south of Aachen. Since 1993, Germany has become the leading European country in the number of students earning doctoral degrees at U.S. universities in science and engineering. (Previously, Greece was the major country of orgin of foreign students from Europe.) By 1995, foreign students from Germany earned over 300 doctorial degrees from U.S. universities, over 200 of them in fields of science and engineering (NSF, 1996).

The proportion of foreign students from particular regions will most likely affect the focus of major European countries in training scientists and engineers and in building S&E infrastructure in developing countries. Based on their training of foreign students, France is intensifying its relations with Africa, and Germany with Eastern Europe. The United Kingdom will have further educational and commercial interactions with her former colonies in the Pacific Rim as well as increasing interaction with the EU countries.

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Notes on Data Series

International Data

Dr. Morton Brown (retired) of the Division of Statistics of the United Nations Educational, Scientific, and Cultural Organization (UNESCO) provided the National Science Foundation with available data on enrollments and graduates in six fields of science and engineering, by gender, for more than 100 countries for the period 1975–88. The fields of study (i.e., a student's main area of specialization) were as follows: social and behavioral science; natural science; mathematics and computer science; engineering; agricultural science; and medical science (not used in this report).

Dr. Brown provided data in these fields by level of programs. The definitions used for program levels are based on the International Standard Classification of Education. Program level 6 was used for first university degree or equivalent qualification in this report. Programs of this type compose those leading to typical first university degrees, such as a bachelor's degree, or to first professional degrees awarded after completion of studies in medicine, engineering, or law.

Ms. Lilia Campo-Opeña, of UNESCO's Division of Statistics, has provided updates of science and engineering degree data for all European countries.

Organisation for Economic Co-operation and Development Data

The Organisation for Economic Co-operation and Development (OECD) Main Science and Technology Indicators were used for research and development (R&D) expenditures, gross domestic product, and purchasing power parity (PPP) conversions for each country. Current national currencies were converted to constant 1987 national currencies and then converted to 1987 constant PPPs. PPP conversions make real comparisons across countries possible and are preferable to using the official exchange rate to compare R&D across countries because the latter measure is volatile.

OECD's Education at a Glance provided first university degree data for European many countries for the period 1985–91.

Demographic Data

UNESCO's Division of Statistics provided demographic data by age segments for all countries. Dr. My T. Vu, demographer of the World Bank, provided population projections for all European countries.

National Data

French degree data: Total first university degrees in all fields were estimated by adding the following degrees from universities, national polytechnics, engineering schools, and private business schools: *maîtrise, diplôme de docteur et capacité en médecine, diplôme d'ingénieur,* and *diplôme d'écoles supérieures de commerce*. Only Group I of private commerce schools are included—those recognized by the state, with a diploma accredited by the Ministry of Education.

The data on the number of social science degrees in France presented in the appendix tables are incomplete. Omitted are degrees in political science and "human sciences." The former are combined with law degrees and the latter with literature degrees in the French detailed statistical tables on university diplomas. In 1992, nearly 20,000 degrees in literature and human sciences were awarded by French universities, some unknown fraction of which should be included in social science degrees.

German degree data: Both *Fachochschulen* and university degrees are included as first university degrees.

United Kingdom data: Degrees from universities only are included in the 1975–1991 data; degrees from colleges and polytechnics are included with university degrees in 1992 degree data.

Belgian data: Two data series were used: UNESCO for 1975–1985 and OECD's Center for Educational Research and Innovation (CERI) for 1985–1991. Because there was a great deal of difference between the numbers in the two series, only the OECD data from the past 6 years were analyzed. The social science degree data include law degrees, the second most popular major in the university.

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Appendix Tables

Appendix table 1. Participation rate of 24-year-olds in first university degrees in the natural sciences and engineering, by region/country: 1992 or most current year

Region/country	Degree fields				24-year-olds			
	All first univ. degrees	Natural sciences	Social sciences	Engineering	Total number	With first univ. degree	With NS&E degree	With soc. sci. degree
	Number					Percent		
Asia								
Total Asia	1,725,323	242,879	236,018	280,772	43,717,235	3.8	1.2	0.5
China	298,438	33,966	36,009	120,830	25,017,278	1.2	0.6	0.1
India	750,000	147,036	NA	29,000	15,545,800	4.8	1.1	NA
Japan[1]	437,878	26,460	177,240	88,385	1,868,387	23.4	6.2	9.5
Singapore	6,000	1,278	117	1,220	52,400	11.5	4.8	0.0
South Korea	178,632	26,685	18,253	31,800	871,581	20.5	6.7	2.1
Taiwan	54,375	7,454	4,399	9,537	361,789	15.0	5.9	1.2
Europe								
Total Europe	1,004,493	140,126	116,353	158,931	7,432,867	13.5	4.0	1.6
European Union	823,357	121,000	111,406	113,748	5,877,146	14.0	4.0	1.9
Austria	10,669	1,552	758	1,048	124,926	8.5	2.1	0.6
Belgium	19,027	1,327	5,409	4,999	143,517	13.3	4.4	3.8
Denmark	12,542	1,038	670	2,679	78,432	16.0	4.7	0.9
Finland	12,386	1,818	744	2,939	74,371	16.7	6.4	1.0
France	111,808	17,896	8,509	17,847	858,554	13.0	4.2	1.0
Germany	176,704	29,900	37,126	38,852	1,376,072	12.8	5.0	2.7
Greece	18,432	2,959	1,967	1,997	154,946	11.9	3.2	1.3
Ireland	9,409	1,714	491	1,096	62,244	15.1	4.5	0.8
Italy	96,225	13,148	19,311	7,900	921,010	10.4	2.3	2.1
The Netherlands	20,712	2,775	4,973	2,759	241,690	8.6	2.3	2.1
Portugal	12,053	1,904	1,129	1,222	164,800	7.3	1.9	0.7
Spain	128,784	13,778	5,519	9,193	660,040	19.5	3.5	0.8
Sweden	15,932	1,591	1,200	2,417	117,964	13.5	3.4	1.0
United Kingdom[2]	178,674	29,600	23,600	18,800	898,580	20.8	5.6	2.8
European Free Trade Association	30,084	1,983	1,524	2,857	177,915	16.9	2.7	0.9
Norway	20,919	519	600	2,080	67,800	30.9	3.8	0.9
Switzerland	9,165	1,464	924	777	110,115	8.3	2.0	0.8
Central Europe	151,052	17,143	3,423	42,326	1,377,806	11.0	4.3	0.2
Bulgaria	23,886	2,388	460	6,548	117,381	20.3	7.6	0.4
Czech Republic	18,160	2,351	164	5,915	146,187	12.4	5.7	0.1
Hungary	13,078	1,061	566	1,292	138,380	9.5	1.7	0.4
Poland	55,360	6,860	2,081	7,440	515,925	10.7	2.8	0.4
Romania	29,901	3,094	127	16,737	381,306	7.8	5.2	0.0
Slovak Republic	10,667	1,389	25	4,394	78,627	13.6	7.4	0.0
North America								
Total North America	1,412,662	133,918	218,026	108,959	5,896,393	24.0	4.1	3.7
Canada	114,861	13,379	24,133	7,124	388,426	29.6	5.3	6.2
Mexico[3]	147,729	9,381	11,727	39,894	1,753,814	8.4	2.8	0.7
United States	1,150,072	111,158	182,166	61,941	3,754,153	30.6	4.6	4.9

NS&E = Natural sciences and engineering; NA = not available

NOTES: Data are compiled from numerous national and international sources, and degree fields may not be strictly comparable. First university degrees in different countries are of different duration and may not be academically equivalent. Data for India and Singapore are for 1990. Data for Belgium, Canada, Denmark, Greece, Ireland, the Netherlands, Portugal, Spain, Austria, Finland, Norway, Sweden, and Hungary are for 1991. All other country data are for 1992. See Notes on Data Series for degrees included in first university degrees.

[1] Japanese social sciences data include business administration.
[2] U.K. data include colleges and polytechnics in 1992.
[3] Mexican social science data are estimated.

SOURCES: National sources.

Appendix table 2. Proportion of total first university degrees obtained in science and engineering in selected European countries and the United States: 1975-92

Year	Total Western Europe	United States	Total EU	Austria	Belgium	Denmark	Finland	France	Germany	Greece
Natural sciences[1]										
1975	15.5	12.6	15.8	6.3	NA	NA	18.8	18.7	14.7	NA
1976	15.2	12.9	15.5	4.9	3.6	1.3	17.8	17.8	14.8	14.0
1977	14.9	13.1	15.2	4.9	3.3	3.8	17.3	17.2	14.3	13.3
1978	14.9	12.9	15.2	12.6	1.7	5.0	17.0	16.5	14.4	15.3
1979	14.4	12.8	14.7	11.7	2.5	4.7	16.8	15.9	14.1	16.1
1980	14.5	12.5	14.8	11.3	3.6	5.2	17.7	15.3	14.2	19.9
1981	14.9	12.5	15.3	9.9	3.4	5.7	18.0	14.8	15.4	20.2
1982	14.6	12.6	14.9	10.7	3.3	6.0	19.3	14.2	15.6	20.6
1983	15.0	12.6	15.3	10.6	1.8	5.9	16.5	13.7	15.1	20.4
1984	14.9	13.1	15.2	12.2	2.3	6.6	14.9	14.3	14.7	19.4
1985	14.2	13.7	14.4	12.1	9.3	9.5	16.5	14.1	14.4	19.2
1986	14.4	13.7	14.6	11.9	10.8	9.7	17.5	15.6	14.6	16.2
1987	14.3	13.3	14.5	13.0	10.4	9.0	13.7	15.5	14.4	17.7
1988	14.7	12.2	14.9	13.8	10.0	9.3	14.9	15.7	14.8	16.9
1989	14.3	11.3	14.5	14.4	6.1	7.8	10.6	15.8	15.6	16.0
1990	14.7	9.9	15.0	14.4	5.7	6.6	14.3	14.8	16.2	16.4
1991	14.7	9.5	15.1	14.5	7.0	8.3	14.7	15.3	16.1	16.1
1992	14.7	9.7	14.7	14.5	7.0	8.3	14.7	16.0	16.5	16.1
Engineering										
1975	14.7	4.3	14.9	10.8	NA	NA	9.2	27.7	17.5	6.9
1976	12.1	4.2	12.4	9.4	6.5	NA	8.8	26.8	16.1	7.9
1977	13.3	4.5	13.7	8.5	8.3	11.2	7.5	24.7	17.3	9.4
1978	13.2	5.1	13.5	8.1	9.3	10.0	7.4	23.6	17.9	8.5
1979	12.6	5.7	12.9	8.4	8.4	10.1	9.0	23.3	17.4	7.4
1980	12.7	6.3	13.0	9.6	7.6	11.6	10.2	22.5	17.8	8.1
1981	13.5	6.7	13.9	7.9	7.4	11.9	10.8	21.3	18.2	9.6
1982	13.2	7.0	13.5	7.6	7.2	11.8	12.1	20.5	16.8	10.7
1983	13.2	7.4	13.5	7.7	7.0	12.9	11.3	19.9	16.1	10.7
1984	13.2	7.7	13.5	7.7	7.7	19.4	10.0	19.3	16.5	8.3
1985	12.7	7.8	13.0	7.4	8.4	16.2	25.3	19.2	17.0	10.1
1986	13.2	7.7	13.5	7.6	18.7	20.0	23.7	18.0	18.0	9.8
1987	13.6	7.4	13.7	8.2	22.1	20.4	23.9	17.8	19.2	8.4
1988	13.8	7.0	14.0	8.2	22.5	23.2	20.5	18.1	19.2	8.4
1989	13.8	6.5	14.0	9.0	18.6	19.6	21.0	17.7	20.6	8.5
1990	14.4	6.1	14.6	9.5	19.3	21.7	23.4	16.7	22.5	11.2
1991	14.4	5.6	14.7	9.8	26.3	21.4	23.7	16.0	22.2	10.8
1992	13.7	5.4	13.8	9.8	26.3	21.4	23.7	16.0	22.0	10.8

See explanatory information and SOURCES at end of table.

Appendix table 2. Proportion of total first university degrees obtained in science and engineering in selected European countries and the United States: 1975-92

Year	Ireland	Italy	Netherlands	Portugal	Spain	Sweden	U.K.[2]	Total EFTA	Norway	Switzerland
Natural sciences[1]										
1975	16.9	15.6	13.1	NA	NA	6.7	26.5	NA	NA	15.6
1976	15.9	15.4	14.7	NA	22.2	5.1	26.3	NA	NA	16.3
1977	13.3	15.8	14.8	NA	22.5	4.9	25.2	NA	NA	15.9
1978	16.1	15.4	17.1	NA	21.1	4.7	24.7	NA	NA	14.8
1979	17.5	14.6	14.8	NA	14.0	4.7	24.5	NA	NA	16.7
1980	15.1	15.3	14.0	NA	12.5	3.8	24.4	NA	NA	16.7
1981	17.5	16.1	14.2	NA	13.2	3.3	24.9	NA	NA	16.7
1982	18.2	15.9	14.3	NA	9.3	3.1	25.3	NA	NA	16.8
1983	22.1	15.9	15.6	NA	14.7	4.0	25.6	NA	NA	16.8
1984	19.8	15.6	15.3	NA	14.4	4.2	25.9	NA	NA	16.8
1985	19.4	14.9	13.9	10.8	7.9	5.4	25.7	8.7	4.4	15.8
1986	16.4	15.1	13.9	11.5	8.4	6.9	24.1	9.4	4.9	16.1
1987	18.5	15.1	15.0	5.1	8.5	8.4	25.6	8.5	4.0	17.1
1988	18.4	15.2	16.7	5.5	10.0	9.0	25.5	7.8	3.0	17.1
1989	19.6	14.6	12.4	10.1	10.3	9.4	23.6	7.6	2.6	17.6
1990	21.7	14.6	14.3	16.4	10.9	10.2	23.6	7.3	2.8	17.1
1991	18.2	14.3	13.4	15.8	10.7	10.0	23.7	6.9	2.5	17.6
1992	18.2	13.7	13.4	15.8	10.7	10.0	16.6	6.6	2.5	16.0
Engineering										
1975	9.7	9.9	19.9	NA	NA	12.8	14.3	NA	NA	9.8
1976	7.9	9.7	17.1	NA	NA	10.2	13.3	NA	NA	7.3
1977	6.7	9.6	18.1	NA	12.2	10.6	13.4	NA	NA	8.9
1978	10.3	9.5	11.6	NA	11.3	10.9	13.5	NA	NA	8.7
1979	8.8	9.6	13.0	NA	5.2	11.1	13.8	NA	NA	9.1
1980	9.5	9.5	13.4	NA	4.1	10.8	14.1	NA	NA	9.1
1981	9.9	9.4	12.4	NA	11.8	10.4	14.5	NA	NA	9.1
1982	10.3	9.1	11.6	NA	12.4	10.1	14.2	NA	NA	9.0
1983	15.8	8.8	11.6	NA	13.6	10.2	14.3	NA	NA	9.0
1984	14.0	8.6	12.7	NA	13.1	10.5	14.4	NA	NA	9.0
1985	12.0	7.9	12.1	10.4	7.0	11.3	13.4	4.1	1.8	7.9
1986	12.6	8.1	11.9	12.5	6.8	13.1	13.8	4.9	2.4	8.5
1987	11.5	7.8	13.7	15.1	6.6	14.7	13.1	8.5	8.8	8.0
1988	11.9	7.9	16.0	15.7	6.7	13.9	13.7	8.7	8.6	8.9
1989	13.7	8.3	11.8	17.8	6.4	14.5	13.3	11.0	12.4	8.0
1990	13.7	8.3	12.4	10.5	6.7	15.2	12.6	9.5	10.2	8.0
1991	11.6	8.5	13.3	10.1	7.1	15.2	12.2	9.3	9.9	7.9
1992	11.6	8.2	13.3	10.1	7.1	15.2	10.5	9.3	9.9	8.5

See explanatory information and SOURCES at end of table.

Appendix table 2. Proportion of total first university degrees obtained in science and engineering in selected European countries and the United States: 1975-92

Year	Total Western Europe	United States	Total EU	Austria	Belgium	Denmark	Finland	France	Germany	Greece
Natural sciences and engineering										
1975	30.1	16.8	30.7	17.1	NA	NA	28.0	46.4	32.2	6.9
1976	27.3	17.1	27.9	14.3	10.1	N.A	26.6	44.6	31.0	21.9
1977	28.2	17.6	28.9	13.4	11.6	15.0	24.7	41.9	31.6	22.6
1978	28.1	18.0	28.7	20.8	11.0	15.1	24.4	40.1	32.3	23.8
1979	27.0	18.5	27.6	20.1	10.9	14.9	25.8	39.2	31.6	23.5
1980	27.2	18.8	27.9	20.8	11.2	16.7	27.8	37.9	32.0	28.0
1981	28.5	19.3	29.1	17.7	10.8	17.6	28.8	36.1	33.6	29.8
1982	27.8	19.6	28.4	18.3	10.5	17.8	31.4	34.7	32.5	31.3
1983	28.2	20.1	28.9	18.3	8.8	18.8	27.8	33.5	31.2	31.1
1984	28.1	20.8	28.7	20.0	10.0	26.1	24.8	33.7	31.2	27.7
1985	26.9	21.6	27.3	19.4	17.7	25.6	41.8	33.3	31.4	29.3
1986	27.6	21.4	28.1	19.5	29.5	29.8	41.2	33.6	32.6	26.0
1987	27.9	20.7	28.3	21.3	32.5	29.4	37.6	33.3	33.6	26.1
1988	28.4	19.2	28.9	22.1	32.5	32.5	35.3	33.8	34.0	25.3
1989	28.1	17.8	28.5	23.4	24.8	27.4	31.6	33.5	36.3	24.5
1990	29.1	16.0	29.6	23.9	24.9	28.3	37.7	31.5	38.7	27.6
1991	29.1	15.1	29.7	24.4	33.2	29.6	38.4	31.3	38.2	26.9
1992	27.8	15.1	28.2	24.4	33.2	29.6	38.4	31.3	38.9	26.9
Social science										
1975	14.4	17.5	14.9	2.3	NA	NA	20.2	1.9	23.8	NA
1976	13.8	16.8	14.3	3.2	7.7	NA	12.4	2.2	24.2	19.2
1977	14.8	16.0	15.3	2.2	6.8	4.5	12.3	2.6	24.8	16.9
1978	14.6	15.5	15.1	3.0	6.8	5.1	11.1	3.0	24.0	17.7
1979	14.4	14.9	14.9	4.0	7.5	5.3	9.9	3.5	22.9	18.5
1980	13.9	14.4	14.3	3.4	8.3	5.9	10.3	4.1	21.8	16.7
1981	13.2	14.0	13.6	3.0	7.8	5.7	9.2	4.8	22.0	12.5
1982	13.3	13.9	13.7	5.3	7.4	6.7	8.7	5.6	22.4	11.3
1983	14.0	13.1	14.0	5.5	7.4	6.0	7.7	6.6	22.9	10.4
1984	14.0	12.8	14.5	5.0	8.4	6.4	7.1	6.5	23.0	13.6
1985	13.8	12.6	14.1	5.6	17.3	7.6	6.3	6.6	22.9	11.0
1986	14.6	12.8	14.8	5.7	23.4	7.4	6.9	6.9	23.2	10.6
1987	14.2	13.2	14.5	5.5	25.4	7.7	6.4	7.1	22.7	14.5
1988	13.7	13.6	14.1	5.4	22.5	7.7	5.5	7.5	22.9	12.6
1989	13.8	14.2	14.1	6.1	21.6	5.9	6.9	8.1	23.0	10.9
1990	13.5	15.0	13.8	6.5	21.6	5.5	7.8	7.2	22.1	9.5
1991	13.2	15.4	13.7	7.1	28.4	5.3	6.0	7.1	20.8	10.7
1992	13.2	15.8	13.5	7.1	28.4	5.3	6.0	7.6	21.0	10.7

See explanatory information and SOURCES at end of table.

Appendix table 2. Proportion of total first university degrees obtained in science and engineering in selected European countries and the United States: 1975-92

Year	Ireland	Italy	Netherlands	Portugal	Spain	Sweden	U.K.[2]	Total EFTA	Norway	Switzerland
Natural sciences and engineering										
1975	26.6	25.5	33.1	NA	NA	19.5	40.8	NA	NA	25.4
1976	23.9	25.1	31.8	NA	22.2	15.3	39.6	NA	NA	23.6
1977	20.0	25.4	32.9	NA	34.7	15.5	38.6	NA	NA	24.9
1978	26.4	24.9	28.7	NA	32.4	15.7	38.2	NA	NA	23.5
1979	26.3	24.3	27.8	NA	19.2	15.8	38.3	NA	NA	25.8
1980	24.6	24.9	27.3	NA	16.6	14.6	38.5	NA	NA	25.8
1981	27.3	25.5	26.5	NA	25.0	13.8	39.4	NA	NA	25.8
1982	28.5	25.0	25.9	NA	21.7	13.3	39.5	NA	NA	25.8
1983	37.9	24.7	27.2	NA	28.3	14.2	39.9	NA	NA	25.8
1984	33.8	24.2	28.0	NA	27.5	14.7	40.4	NA	NA	25.8
1985	31.4	22.8	26.0	21.3	14.9	16.6	39.1	12.8	6.2	23.7
1986	29.0	23.1	25.8	23.9	15.2	20.0	37.9	14.2	7.3	24.6
1987	30.1	22.9	28.6	20.2	15.1	23.1	38.7	17.0	12.7	25.1
1988	30.3	23.1	32.7	21.2	16.6	22.9	39.2	16.5	11.6	26.0
1989	33.2	22.9	24.2	27.9	16.8	23.9	36.9	18.6	15.1	25.7
1990	35.5	22.9	26.7	26.9	17.6	25.5	36.2	16.8	13.0	25.1
1991	29.9	22.8	26.7	25.9	17.8	25.2	35.9	16.3	12.4	25.5
1992	29.9	21.9	26.7	25.9	17.8	25.2	27.1	16.1	12.4	24.5
Social science										
1975	5.0	7.4	21.8	NA	NA	35.3	17.3	NA	NA	NA
1976	5.9	7.4	21.7	NA	23.5	18.4	15.2	NA	NA	NA
1977	5.0	7.5	21.8	NA	25.8	13.4	21.1	NA	NA	NA
1978	4.8	8.0	21.4	NA	33.6	9.8	17.9	NA	NA	NA
1979	8.2	7.9	22.0	NA	25.7	9.5	17.7	NA	NA	NA
1980	7.6	7.4	21.8	NA	24.2	6.6	17.5	NA	NA	NA
1981	7.9	6.9	20.7	NA	24.4	4.6	14.9	NA	NA	NA
1982	8.3	9.5	21.5	NA	19.6	3.2	14.7	NA	NA	NA
1983	6.5	13.1	18.4	NA	16.3	3.4	15.0	NA	NA	NA
1984	7.2	13.7	19.8	NA	15.2	3.6	16.4	NA	NA	NA
1985	7.0	14.5	20.7	8.0	8.8	3.8	17.3	5.3	3.3	8.6
1986	6.1	15.2	26.1	10.8	10.1	3.4	16.8	5.7	3.2	9.3
1987	6.3	17.5	30.6	9.1	5.9	2.7	17.6	4.3	2.4	8.0
1988	6.3	19.6	20.8	9.4	3.6	2.8	18.5	4.1	2.1	8.1
1989	5.2	19.1	16.6	9.7	4.3	2.6	19.1	4.7	3.0	8.2
1990	5.2	19.6	25.1	9.7	4.5	2.3	15.0	4.9	3.4	8.3
1991	5.2	19.7	24.0	9.4	4.3	7.5	15.2	4.6	2.9	8.8
1992	5.2	20.1	24.0	9.4	4.3	7.5	13.2	5.1	2.9	10.1

See explanatory information and SOURCES at end of table.

Appendix table 2. Proportion of total first university degrees obtained in science and engineering in selected European countries and the United States: 1975-92

Year	Total Western Europe	United States	Total EU	Austria	Belgium	Denmark	Finland	France	Germany	Greece
Science and engineering										
1975	44.5	34.3	45.3	19.4	NA	NA	48.2	48.3	55.9	6.9
1976	41.1	33.9	42.2	17.4	17.8	1.3	39.0	46.8	55.2	41.1
1977	43.1	33.6	44.2	15.6	18.4	19.5	37.1	44.5	56.4	39.5
1978	42.7	33.5	43.9	23.8	17.8	20.1	35.5	43.1	56.3	41.5
1979	41.4	33.4	42.5	24.2	18.4	20.1	35.8	42.8	54.5	42.0
1980	41.1	33.2	42.2	24.3	19.4	22.7	38.1	42.0	53.8	44.6
1981	41.6	33.3	42.8	20.7	18.7	23.3	38.0	40.9	55.7	42.3
1982	41.1	33.5	42.2	23.6	17.9	24.5	40.1	40.4	54.8	42.5
1983	42.0	33.2	42.8	23.7	16.2	24.8	35.5	40.1	54.2	41.5
1984	42.1	33.6	43.2	24.9	18.3	32.5	32.0	40.2	54.2	41.3
1985	40.7	34.2	41.4	25.1	35.0	33.2	48.1	39.9	54.2	40.3
1986	42.2	34.1	42.9	25.2	52.9	37.1	48.1	40.5	55.9	36.5
1987	42.0	33.9	42.7	26.7	57.9	37.1	44.1	40.4	56.3	40.5
1988	42.2	32.8	43.0	27.5	55.0	40.2	40.9	41.3	56.9	37.8
1989	41.9	32.0	42.6	29.5	46.3	33.3	38.5	41.5	59.2	35.5
1990	42.6	31.0	43.4	30.4	46.5	33.8	45.5	38.7	60.8	37.1
1991	42.3	30.5	43.4	31.5	61.7	35.0	44.4	38.4	59.1	37.6
1992	40.8	30.9	41.5	31.5	61.7	35.0	44.4	35.6	58.3	37.6

See explanatory information and SOURCES at end of table.

Appendix table 2. Proportion of total first university degrees obtained in science and engineering in selected European countries and the United States: 1975-92

Year	Ireland	Italy	Netherlands	Portugal	Spain	Sweden	U.K.[2]	Total EFTA	Norway	Switzerland
Science and engineering										
1975	31.6	33.0	54.9	NA	NA	54.8	58.2	NA	NA	25.4
1976	29.8	32.5	53.4	NA	45.7	33.6	54.8	NA	NA	23.6
1977	25.0	32.8	54.7	NA	60.4	28.8	59.7	NA	NA	24.9
1978	31.2	32.9	50.1	NA	66.0	25.4	56.2	NA	NA	23.5
1979	34.4	32.2	49.8	NA	44.8	25.3	56.0	NA	NA	25.8
1980	32.2	32.3	49.1	NA	40.8	21.2	56.1	NA	NA	25.8
1981	35.2	32.5	47.3	NA	49.3	18.4	54.3	NA	NA	25.8
1982	36.8	34.5	47.4	NA	41.3	16.5	54.2	NA	NA	25.8
1983	44.3	37.8	45.6	NA	44.7	17.7	54.1	NA	NA	25.8
1984	41.1	37.9	47.9	NA	42.8	18.3	56.8	NA	NA	25.8
1985	38.5	37.3	46.7	29.3	23.7	20.4	56.3	18.1	9.5	32.3
1986	35.0	38.4	51.9	34.7	25.3	23.4	54.8	19.9	10.5	33.9
1987	36.4	40.4	59.2	29.3	21.0	25.7	56.3	21.3	15.2	33.1
1988	36.6	42.6	53.5	30.6	20.2	25.8	57.6	20.6	13.6	34.1
1989	38.4	42.0	40.8	37.6	21.0	26.5	56.0	23.3	18.0	33.9
1990	40.7	42.4	51.7	36.6	22.2	27.8	51.2	21.8	16.4	33.4
1991	35.1	42.5	50.7	35.3	22.1	32.7	51.1	20.9	15.3	34.3
1992	35.1	41.9	50.7	35.3	22.1	32.7	40.3	21.2	15.3	34.5

EU = European Union; EFTA = European Free Trade Association; NA = not available

NOTES: Data are compiled from numerous national and international sources, and degree fields may not be strictly comparable. Detailed national education data were available for Austria, France, Germany, Switzerland, and the United Kingdom. These data were reconfigured to the International Standard Classification of Instructional Programs. First university degrees in different countries are of different duration and may not be academically equivalent. Data for Germany includes East and West German data for 1990-92; prior years (1975-89) include only West German data. The Netherlands and United Kingdom data do not include open universities. See Notes on Data Series for degrees included in first university degrees.

[1] Natural sciences in this table include mathematics and computer science and agricultural sciences as well as physical, biological, and environmental sciences.

[2] U.K. 1992 data include polytechnics brought into the university system.

SOURCES: Organisation for Economic Co-operation and Development (OECD), Center for Research and Innovation (CERI) "Education at a Glance" database, 1994; United Nations Educational, Scientific, and Cultural Organization, *Statistical Yearbook,* annual series, supplemented by national sources: Austria—Austrian Central Statistical Office, Population Division, unpublished tabulations; France—Ministère de l'Education Nationale, *Repères et Références: Statistiques sur* les Enseignements; Germany—Statistisches Bundesamt Wiesbaden, *Prüfungen an Hochschulen;* Switzerland—Federal Office of Statistics, Education and Society Division, Universities and Science Section, unpublished tabulations; United Kingdom—University Grants Committee, *University Statistics,* Universities Statistical Record, and the Department of Education and Science, unpublished tabulations; United States—National Science Foundation, Science Resources Studies Division, *Science and Engineering Degrees: 1966-93,* NSF 95-319 (Arlington, VA: NSF, 1995). For additional national sources, see Contacts and References.

Appendix table 3. Doctoral degrees in science and engineering, by country/region: 1992

Country	All Ph.D.s	Natural sciences	Social sciences	Engineering	Total S&E
Total Asia	25,590	6,593	544	4,630	11,767
China	1,812	473	61	823	1,357
India	8,383	3,665	NA	629	4,294
Japan[1]	11,576	1,833	243	2,362	4,438
South Korea	3,211	459	217	552	1,228
Taiwan	608	163	23	264	450
Total Europe	47,128	18,951	4,230	6,359	29,540
European Union					
Finland	NA	155	35	66	256
France	8,240	4,579	782	1,192	6,553
Germany	21,438	6,704	1,344	2,100	10,148
Italy	2,698	857	158	303	1,318
Netherlands	NA	554	322	287	1,163
Sweden	1,724	488	127	372	987
United Kingdom	8,396	3,852	935	1,325	6,112
European Free Trade Association					
Norway	415	162	68	80	310
Switzerland	2,119	700	77	117	894
Central Europe					
Hungary	598	266	248	84	598
Poland	1,500	634	134	433	1,201
Total North America	42,701	13,344	7,423	6,105	26,872
Canada	2,947	789	490	409	1,688
United States	39,754	12,555	6,933	5,696	25,184

S&E = science and engineering; NA = not available

NOTES: Canadian data are for 1991. All other country data are for 1992.

[1] Japanese data include "thesis" doctorates called Ronbun Hakase, earned by employees in industry. See section on Asian Doctoral Programs.

SOURCES: Asian countries—*Human Resources for Science and Technology: the Asian Region,* NSF 93-303; European Countries—Gov. of Austria, Austrian Central Statistical Office, Population Division, unpublished tabulations; France—Ministère de l'Education Nationale, *Repères et Références: Statistiques sur les Enseignements*; Germany—Statistisches Bundesamt Wiesbaden, *Prüfungen an Hochschulen;* Switzerland—Federal Office of Statistics, Education and Society Division, Universities and Science Section, unpublished tabulations; United Kingdom—University Grants Committee, Universities Statistical Record, unpublished tabulations. North American countries: Canada—Statistics Canada, *Universities: Enrollment and Degrees, 1991;* United States—National Science Foundation, Science Resources Studies Division, *Science and Engineering Degrees: 1966-93,* NSF 95-312 (Arlington, VA: NSF, 1995). For additional national sources, see Contacts and References.

Appendix table 4. Enrollment in higher education in European countries and the United States: 1975-91

Year	Total Europe	United States	Total EU	Austria	Belgium	Denmark	Finland	France	Germany
1975	6,767,046	11,290,719	5,504,425	96,736	159,660	110,271	114,272	1,038,576	1,041,225
1976	7,037,775	11,121,626	5,694,638	104,525	169,649	110,637	119,274	1,042,738	1,054,289
1977	7,224,591	11,415,020	5,881,970	114,327	178,060	109,152	120,557	1,053,943	1,107,834
1978	7,421,601	11,391,950	6,078,377	125,048	186,888	107,687	121,854	1,065,269	1,164,099
1979	7,629,289	11,707,126	6,284,355	136,774	196,153	106,241	123,165	1,076,717	1,223,221
1980	7,655,024	12,234,644	6,309,311	136,774	196,153	106,241	123,165	1,076,717	1,223,221
1981	7,857,997	12,517,753	6,552,170	140,720	213,281	106,669	124,831	1,150,055	1,325,179
1982	7,994,097	12,588,520	6,749,352	146,351	219,591	110,731	127,657	1,179,268	1,405,478
1983	8,248,250	12,633,930	7,031,400	154,126	226,890	113,157	120,153	1,131,219	1,471,964
1984	8,593,736	12,400,392	7,391,599	165,313	245,762	114,559	121,182	1,255,538	1,519,050
1985	8,768,369	12,411,945	7,567,129	173,215	247,499	116,319	127,976	1,278,581	1,550,211
1986	8,945,503	12,670,121	7,723,057	179,909	252,236	118,641	133,933	1,289,942	1,579,085
1987	9,257,356	12,925,116	8,007,706	186,323	254,329	122,256	139,375	1,327,771	1,626,334
1988	9,646,398	13,205,540	8,331,539	192,966	260,608	126,662	146,857	1,390,000	1,686,725
1989	10,209,810	13,621,203	8,832,609	199,845	271,007	134,731	155,313	1,587,202	1,719,763
1990	10,855,952	13,871,725	9,364,328	205,767	276,248	142,968	165,714	1,698,938	1,799,394
1991	11,444,525	14,527,881	9,932,463	216,529	276,248	150,159	173,702	1,840,307	1,867,491

	Greece	Ireland	Italy	Nether-lands	Portugal	Spain	Sweden	U.K.
1975	117,246	46,174	976,712	288,026	79,702	540,238	162,640	732,947
1976	122,833	46,515	1,020,762	305,150	95,841	581,064	171,181	750,180
1977	122,258	49,111	1,052,116	322,446	94,595	617,624	171,225	768,723
1978	121,686	51,852	1,084,433	340,721	93,366	656,484	171,268	787,724
1979	121,116	54,746	1,117,742	360,033	92,152	697,789	171,312	807,194
1980	121,116	54,746	1,117,742	360,033	92,152	697,789	171,356	832,106
1981	124,694	59,824	1,104,176	371,515	94,958	721,806	176,115	838,347
1982	137,453	64,116	1,090,775	379,047	99,165	750,201	181,103	858,416
1983	148,515	64,561	1,120,342	384,407	101,308	810,391	184,199	1,000,168
1984	167,957	67,378	1,181,953	390,244	112,851	857,036	185,787	1,006,989
1985	181,901	70,301	1,161,361	404,866	103,585	935,126	183,697	1,032,491
1986	197,808	73,450	1,141,127	408,494	129,277	976,558	183,645	1,058,952
1987	189,173	77,196	1,227,809	412,154	138,131	1,036,439	184,324	1,086,092
1988	187,644	81,133	1,296,298	415,847	147,592	1,101,297	184,569	1,113,341
1989	194,419	85,138	1,358,254	437,488	157,701	1,169,141	184,815	1,177,792
1990	195,213	90,296	1,452,286	478,869	185,762	1,222,089	192,596	1,258,188
1991	195,213	101,108	1,533,202	493,563	190,856	1,301,748	207,265	1,385,072

See explanatory information and SOURCE at end of table.

Appendix table 4. Enrollment in higher education in European countries and the United States: 1975-91

Year	Total EFTA	Norway	Switzer-land	Central Europe	Bulgaria	Czecho-slovakia	Hungary	Poland	Romania
1975	131,348	66,628	64,720	1,131,273	128,593	155,059	107,555	575,499	164,567
1976	145,695	73,320	72,375	1,197,442	129,507	168,677	110,528	613,842	174,888
1977	150,575	75,204	75,372	1,192,046	121,811	175,360	108,109	607,570	179,196
1978	155,628	77,135	78,492	1,187,596	114,572	182,308	105,743	601,361	183,611
1979	160,859	79,117	81,742	1,184,074	107,763	189,532	103,429	595,216	188,134
1980	164,244	79,117	85,127	1,181,469	101,359	197,041	101,166	589,134	192,769
1981	170,896	82,511	88,385	1,134,931	97,785	198,784	102,564	544,895	190,903
1982	179,078	88,510	90,568	1,065,667	95,723	192,397	100,564	495,902	181,081
1983	186,991	91,330	95,661	1,029,859	98,612	181,524	99,865	475,816	174,042
1984	199,986	94,089	105,897	1,002,151	104,333	174,843	99,986	456,661	166,328
1985	204,769	94,658	110,111	996,471	113,795	169,344	99,344	454,190	159,798
1986	221,263	104,246	117,017	1,001,183	125,576	169,723	98,505	450,205	157,174
1987	228,597	106,904	121,693	1,021,053	135,852	170,550	99,025	458,585	157,041
1988	240,014	114,855	125,159	1,074,845	137,855	184,849	99,124	493,552	159,465
1989	262,096	129,343	132,753	1,115,105	157,861	186,142	100,868	505,727	164,507
1990	280,007	142,521	137,486	1,211,617	188,479	190,409	102,387	544,893	185,449
1991	297,247	154,180	143,067	1,214,815	185,914	177,110	107,079	535,656	209,056

EU = European Union; EFTA = European Free Trade Association

SOURCE: United Nations Educational, Scientific, and Cultural Organization, (UNESCO), unpublished tabulations.

Appendix table 5. First university degrees in science and engineering in selected European countries and the United States: 1975-92

Year	Total Western Europe	United States	Total EU	Austria	Belgium	Denmark	Finland	France	Germany	Greece
					Natural sciences[1]					
1975	53,974	117,001	52,903	269	NA	NA	1,787	6,746	15,515	NA
1976	63,311	120,609	62,363	270	562	155	2,220	6,821	16,067	1,796
1977	64,692	121,819	63,752	292	568	396	2,009	7,064	16,201	1,532
1978	66,415	120,238	65,537	762	329	538	1,901	7,316	16,023	2,195
1979	66,133	119,118	65,142	761	432	494	1,796	7,576	15,826	2,736
1980	67,937	117,964	66,939	861	567	531	1,779	7,846	16,122	2,961
1981	70,786	118,667	69,780	814	582	584	1,777	8,126	16,872	2,809
1982	72,107	121,552	71,092	948	597	610	1,734	8,415	18,485	2,989
1983	75,988	123,973	74,964	932	360	597	1,590	8,715	18,698	3,102
1984	77,362	129,149	76,329	1,071	465	592	1,530	9,406	18,689	2,962
1985	81,437	136,047	79,807	1,032	1,862	739	1,818	10,009	18,974	2,950
1986	83,718	136,910	82,018	1,095	1,882	801	1,998	11,391	19,709	2,579
1987	87,392	132,923	85,501	1,269	1,661	767	1,563	12,068	19,984	2,942
1988	93,556	123,115	91,716	1,318	1,809	801	2,028	12,391	20,996	2,848
1989	95,231	116,343	93,327	1,473	1,537	891	1,317	13,270	22,673	2,760
1990	104,806	105,021	102,826	1,510	1,421	815	1,782	14,320	27,735	3,087
1991	107,960	105,383	105,906	1,552	1,327	1,038	1,818	15,900	28,375	2,959
1992	122,983	111,158	121,000	1,552	1,327	1,038	1,818	17,896	29,900	2,959
					Engineering					
1975	51,229	39,824	49,916	457	NA	NA	869	9,956	18,528	957
1976	50,480	38,790	50,053	513	1,030	NA	1,092	10,264	17,434	1,012
1977	57,702	41,357	57,176	502	1,422	1,154	872	10,176	19,658	1,079
1978	58,520	47,251	58,004	490	1,781	1,073	834	10,429	19,879	1,222
1979	57,981	53,469	57,439	549	1,459	1,056	967	11,100	19,492	1,247
1980	59,512	58,810	58,968	730	1,196	1,187	1,023	11,548	20,111	1,211
1981	64,072	63,717	63,526	647	1,253	1,220	1,059	11,754	20,003	1,335
1982	65,061	67,460	64,513	679	1,312	1,198	1,083	12,156	19,862	1,561
1983	66,679	72,670	66,129	679	1,426	1,312	1,082	12,650	20,024	1,620
1984	68,590	76,153	68,038	676	1,550	1,728	1,029	12,670	21,050	1,269
1985	72,620	77,572	71,854	630	1,684	1,264	2,797	13,659	22,412	1,546
1986	76,974	76,820	76,094	694	3,254	1,652	2,698	13,107	24,218	1,569
1987	82,784	74,425	80,892	801	3,545	1,738	2,723	13,848	26,725	1,385
1988	87,723	70,154	85,677	784	4,069	1,994	2,795	14,276	27,278	1,421
1989	92,498	66,947	89,747	922	4,671	2,229	2,595	14,899	29,933	1,457
1990	102,971	64,705	100,391	989	4,832	2,657	2,921	16,080	38,564	2,116
1991	105,867	62,187	103,102	1,048	4,999	2,679	2,939	16,589	39,173	1,997
1992	116,605	61,941	113,748	1,048	4,999	2,679	2,939	17,847	38,852	1,997

See explanatory information and SOURCES at end of table.

Appendix table 5. First university degrees in science and engineering in selected European countries and the United States: 1975-92

Year	Ireland	Italy	Netherlands	Portugal	Spain	Sweden	U.K.[2]	Total EFTA	Norway	Switzerland
					Natural sciences[1]					
1975	640	10,915	1,424	NA	NA	906	14,701	1,071	187	884
1976	689	11,293	1,617	NA	5,001	898	14,974	948	NA	948
1977	715	11,372	1,640	NA	5,951	810	15,202	940	NA	940
1978	807	11,120	1,974	NA	6,141	733	15,698	878	NA	878
1979	868	10,267	1,605	NA	5,899	718	16,164	991	NA	991
1980	889	10,735	1,547	NA	5,847	628	16,626	999	NA	999
1981	983	11,268	1,784	NA	6,339	582	17,260	1,007	NA	1,007
1982	983	11,123	1,949	NA	4,593	583	18,082	1,015	NA	1,015
1983	1,329	11,062	2,308	NA	6,585	740	18,946	1,024	NA	1,024
1984	1,330	11,033	2,388	NA	7,142	857	18,864	1,033	NA	1,033
1985	1,591	10,692	2,285	1,177	7,258	928	18,492	1,630	514	1,116
1986	1,555	10,987	2,466	1,068	8,165	1,097	17,225	1,700	527	1,173
1987	1,755	11,217	3,106	585	9,059	1,404	18,120	1,891	580	1,311
1988	1,831	11,723	4,672	633	11,224	1,527	17,915	1,840	469	1,371
1989	1,768	12,289	3,154	1,167	12,095	1,557	17,376	1,904	441	1,463
1990	2,062	12,260	2,834	1,904	13,302	1,601	18,193	1,980	515	1,465
1991	1,714	12,306	2,775	1,904	13,778	1,591	18,869	2,054	519	1,535
1992	1,714	13,148	2,775	1,904	13,778	1,591	29,600	1,983	519	1,464
					Engineering					
1975	368	6,949	2,162	NA	NA	1,724	7,946	1,313	759	554
1976	343	7,107	1,888	NA	NA	1,796	7,574	427	NA	427
1977	361	6,923	2,002	NA	3,220	1,745	8,062	526	NA	526
1978	515	6,837	1,339	NA	3,304	1,695	8,606	516	NA	516
1979	434	6,733	1,403	NA	2,179	1,713	9,107	542	NA	542
1980	557	6,670	1,479	NA	1,911	1,766	9,579	544	NA	544
1981	556	6,607	1,555	NA	5,671	1,821	10,045	546	NA	546
1982	556	6,350	1,585	NA	6,160	1,878	10,133	548	NA	548
1983	951	6,103	1,727	NA	6,075	1,891	10,589	550	NA	550
1984	943	6,035	1,985	NA	6,486	2,113	10,505	552	NA	552
1985	985	5,686	1,985	1,135	6,486	1,952	9,633	766	210	556
1986	1,200	5,901	2,123	1,163	6,569	2,083	9,863	880	263	617
1987	1,093	5,770	2,835	1,737	6,959	2,460	9,273	1,892	1,281	611
1988	1,181	6,107	4,493	1,810	7,497	2,344	9,628	2,046	1,332	714
1989	1,235	6,944	2,998	2,064	7,566	2,414	9,820	2,751	2,084	667
1990	1,302	6,944	2,456	1,222	8,190	2,377	9,741	2,580	1,891	689
1991	1,096	7,252	2,759	1,222	9,193	2,417	9,739	2,765	2,080	685
1992	1,096	7,900	2,759	1,222	9,193	2,417	18,800	2,857	2,080	777

See explanatory information and SOURCES at end of table.

Appendix table 5. First university degrees in science and engineering in selected European countries and the United States: 1975-92

Year	Total Western Europe	United States	Total EU	Austria	Belgium	Denmark	Finland	France	Germany	Greece
Natural sciences and engineering										
1975	105,203	156,825	102,819	726	NA	NA	2,656	16,702	34,043	957
1976	113,791	159,399	112,416	783	1,592	155	3,312	17,085	33,501	2,808
1977	122,394	163,176	120,928	794	1,990	1,550	2,881	17,240	35,859	2,611
1978	124,935	167,489	123,541	1,252	2,110	1,611	2,735	17,745	35,902	3,417
1979	124,115	172,587	122,582	1,310	1,891	1,550	2,763	18,676	35,318	3,983
1980	127,449	176,774	125,907	1,591	1,763	1,718	2,802	19,394	36,233	4,172
1981	134,858	182,384	133,306	1,461	1,834	1,804	2,836	19,880	36,875	4,144
1982	137,168	189,012	135,605	1,627	1,909	1,808	2,817	20,571	38,347	4,550
1983	142,667	196,643	141,093	1,611	1,786	1,909	2,672	21,365	38,722	4,722
1984	145,952	205,302	144,367	1,747	2,014	2,320	2,559	22,076	39,739	4,231
1985	154,057	213,619	151,661	1,662	3,546	2,003	4,615	23,668	41,386	4,496
1986	160,692	213,730	158,112	1,789	5,136	2,453	4,696	24,498	43,927	4,148
1987	170,176	207,348	166,393	2,070	5,206	2,505	4,286	25,916	46,709	4,327
1988	181,279	193,269	177,393	2,102	5,879	2,795	4,823	26,667	48,274	4,269
1989	187,729	183,290	183,074	2,395	6,208	3,120	3,912	28,169	52,606	4,217
1990	207,777	169,726	203,217	2,499	6,253	3,472	4,703	30,400	66,299	5,203
1991	213,827	167,570	209,008	2,600	6,326	3,717	4,757	32,489	67,548	4,956
1992	239,588	173,099	234,748	2,600	6,326	3,717	4,757	35,743	68,752	4,956
Science and engineering (including social sciences)										
1975	151,891	319,972	151,891	825	NA	NA	4,578	17,402	59,225	NA
1976	169,962	316,804	169,962	956	2,809	NA	4,851	17,930	59,743	5,273
1977	185,139	311,709	185,139	924	3,153	2,015	4,317	18,303	64,035	4,561
1978	188,609	311,507	188,609	1,435	3,412	2,151	3,980	19,081	62,643	5,963
1979	188,524	311,490	188,524	1,573	3,197	2,099	3,824	20,358	60,951	7,121
1980	190,732	312,406	190,732	1,854	3,073	2,326	3,836	21,509	60,885	6,657
1981	195,666	314,991	195,666	1,705	3,161	2,387	3,747	22,540	61,030	5,889
1982	201,124	322,577	201,124	2,098	3,252	2,491	3,599	23,917	64,790	6,187
1983	209,423	325,294	209,423	2,093	3,291	2,521	3,414	25,573	67,161	6,305
1984	217,009	331,380	217,009	2,182	3,702	2,893	3,295	26,371	69,100	6,317
1985	233,212	338,652	229,828	2,144	7,009	2,597	5,308	28,356	71,542	6,190
1986	245,394	341,288	241,786	2,309	9,210	3,061	5,479	29,565	75,166	5,834
1987	256,253	339,283	251,505	2,603	9,273	3,164	5,019	31,398	78,233	6,724
1988	268,892	329,986	264,034	2,615	9,939	3,461	5,579	32,558	80,757	6,393
1989	279,819	330,027	273,984	3,018	11,617	3,794	4,765	34,956	85,961	6,099
1990	304,005	329,094	298,117	3,182	11,662	4,142	5,670	37,391	104,177	6,985
1991	311,219	337,675	305,035	3,358	11,735	4,387	5,501	39,833	104,340	6,923
1992	348,099	355,265	341,735	3,358	11,735	4,387	5,501	39,833	105,878	6,923

See explanatory information and SOURCES at end of table.

Appendix table 5. First university degrees in science and engineering in selected European countries and the United States: 1975-92

Year	Ireland	Italy	Netherlands	Portugal	Spain	Sweden	U.K.[2]	Total EFTA	Norway	Switzerland
Natural sciences and engineering										
1975	1,008	17,864	3,586	NA	NA	2,630	22,647	2,384	946	1,438
1976	1,032	18,400	3,505	NA	5,001	2,694	22,548	1,375	NA	1,375
1977	1,076	18,295	3,642	NA	9,171	2,555	23,264	1,466	NA	1,466
1978	1,322	17,957	3,313	NA	9,445	2,428	24,304	1,394	NA	1,394
1979	1,302	17,000	3,008	NA	8,078	2,431	25,271	1,533	NA	1,533
1980	1,446	17,405	3,026	NA	7,758	2,394	26,205	1,543	NA	1,543
1981	1,539	17,875	3,339	NA	12,010	2,403	27,305	1,553	NA	1,553
1982	1,539	17,473	3,534	NA	10,753	2,461	28,215	1,563	NA	1,563
1983	2,280	17,165	4,035	NA	12,660	2,631	29,535	1,574	NA	1,574
1984	2,273	17,068	4,373	NA	13,628	2,970	29,369	1,585	NA	1,585
1985	2,576	16,378	4,270	2,312	13,744	2,880	28,125	2,396	724	1,672
1986	2,755	16,888	4,589	2,231	14,734	3,180	27,088	2,580	790	1,790
1987	2,848	16,987	5,941	2,322	16,018	3,864	27,393	3,783	1,861	1,922
1988	3,012	17,830	9,165	2,443	18,721	3,871	27,543	3,886	1,801	2,085
1989	3,003	19,233	6,152	3,231	19,661	3,971	27,196	4,655	2,525	2,130
1990	3,364	19,204	5,290	3,126	21,492	3,978	27,934	4,560	2,406	2,154
1991	2,810	19,558	5,534	3,126	22,971	4,008	28,608	4,819	2,599	2,220
1992	2,810	21,048	5,534	3,126	22,971	4,008	48,400	4,840	2,599	2,241
Science and engineering (including social sciences)										
1975	1,199	23,070	5,951	NA	NA	7,382	32,259	NA	NA	NA
1976	1,288	23,798	5,896	NA	10,302	5,927	31,189	NA	NA	NA
1977	1,344	23,692	6,054	NA	15,986	4,765	35,990	NA	NA	NA
1978	1,563	23,742	5,774	NA	19,216	3,939	35,710	NA	NA	NA
1979	1,708	22,569	5,391	NA	18,906	3,899	36,928	NA	NA	NA
1980	1,894	22,599	5,436	NA	19,052	3,478	38,133	NA	NA	NA
1981	1,985	22,720	5,948	NA	23,718	3,204	37,633	NA	NA	NA
1982	1,985	24,096	6,471	NA	20,463	3,052	38,722	NA	NA	NA
1983	2,669	26,219	6,758	NA	19,959	3,264	40,195	NA	NA	NA
1984	2,758	26,759	7,471	NA	21,181	3,698	41,281	NA	NA	NA
1985	3,152	26,752	7,677	3,186	21,832	3,531	40,552	3,384	1,106	2,278
1986	3,331	27,992	9,238	3,237	24,524	3,716	39,124	3,608	1,140	2,468
1987	3,018	29,942	12,286	3,367	22,295	4,308	39,874	4,748	2,215	2,533
1988	3,638	32,945	14,995	3,529	22,745	4,351	40,529	4,858	2,122	2,736
1989	3,473	35,257	10,367	4,360	24,664	4,400	41,253	5,835	3,021	2,814
1990	3,855	35,665	10,263	4,255	27,011	4,345	39,514	5,888	3,026	2,862
1991	3,301	36,466	10,507	4,255	28,490	5,208	40,731	6,184	3,199	2,985
1992	3,301	40,359	10,507	4,255	28,490	5,208	72,000	6,364	3,199	3,165

See explanatory information and SOURCES at end of table.

Appendix table 5. First university degrees in science and engineering in selected European countries and the United States: 1975-92

Year	Total Western Europe	United States	Total EU	Austria	Belgium	Denmark	Finland	France	Germany	Greece
					Total, all fields					
1975	349,090	931,663	335,281	4,246	NA	NA	9,496	36,000	105,883	13,793
1976	416,825	934,443	402,561	5,483	15,781	11,797	12,438	38,273	108,240	12,821
1977	433,320	928,228	418,681	5,934	17,109	10,344	11,644	41,163	113,505	11,534
1978	444,745	930,197	429,765	6,026	19,184	10,684	11,214	44,272	111,276	14,370
1979	458,974	931,340	443,643	6,511	17,410	10,432	10,689	47,615	111,870	16,955
1980	467,726	940,251	452,021	7,634	15,800	10,258	10,076	51,211	113,147	14,914
1981	473,554	946,877	457,463	8,233	16,927	10,225	9,851	55,079	109,666	13,921
1982	493,280	964,043	476,790	8,879	18,135	10,185	8,977	59,238	118,163	14,545
1983	505,855	980,679	488,954	8,817	20,378	10,146	9,616	63,712	124,027	15,196
1984	519,725	986,345	502,398	8,756	20,209	8,905	10,301	65,601	127,413	15,282
1985	573,240	990,880	554,588	8,556	20,042	7,816	11,034	71,139	131,969	15,369
1986	581,705	1,000,352	563,596	9,172	17,399	8,240	11,390	72,921	134,582	15,964
1987	610,609	1,000,532	588,337	9,734	16,027	8,521	11,385	77,734	138,955	16,582
1988	637,532	1,006,033	613,946	9,526	18,081	8,607	13,652	78,833	141,811	16,890
1989	668,280	1,030,171	643,239	10,239	25,064	11,388	12,370	84,211	145,087	17,203
1990	713,724	1,062,151	686,658	10,457	25,064	12,267	12,463	96,548	171,341	18,840
1991	732,715	1,107,997	703,087	10,669	19,027	12,542	12,386	103,837	173,856	18,432
1992	853,441	1,150,072	823,357	10,669	19,027	12,542	12,386	111,808	176,704	18,432

See explanatory information and SOURCES at end of table.

Appendix table 5. First university degrees in science and engineering in selected European countries and the United States: 1975-92

Year	Ireland	Italy	Netherlands	Portugal	Spain	Sweden	U.K.[2]	Total EFTA	Norway	Switzerland
					Total, all fields					
1975	3,794	69,987	10,842	12,323	NA	13,469	55,448	13,809	8,148	5,661
1976	4,321	73,246	11,036	12,031	22,530	17,618	56,946	14,264	8,441	5,823
1977	5,382	72,168	11,064	15,580	26,460	16,519	60,275	14,639	8,744	5,895
1978	5,017	72,164	11,524	15,874	29,114	15,488	63,558	14,980	9,058	5,922
1979	4,959	70,082	10,832	12,807	42,173	15,405	65,903	15,331	9,383	5,948
1980	5,875	70,036	11,075	10,942	46,639	16,386	68,027	15,705	9,720	5,985
1981	5,632	69,991	12,582	10,527	48,078	17,430	69,321	16,091	10,069	6,022
1982	5,400	69,877	13,662	10,128	49,561	18,540	71,500	16,489	10,430	6,059
1983	6,022	69,367	14,835	9,744	44,660	18,481	73,953	16,901	10,805	6,096
1984	6,715	70,548	15,612	10,614	49,531	20,204	72,707	17,327	11,193	6,134
1985	8,193	71,749	16,430	10,875	92,078	17,338	72,000	18,652	11,595	7,057
1986	9,510	72,970	17,795	9,324	97,037	15,861	71,431	18,109	10,821	7,288
1987	9,468	74,085	20,766	11,501	105,972	16,741	70,866	22,272	14,620	7,652
1988	9,934	77,270	28,031	11,544	112,571	16,891	70,306	23,586	15,574	8,012
1989	9,038	84,036	25,430	11,587	117,321	16,610	73,655	25,041	16,748	8,293
1990	9,481	84,036	19,841	11,630	121,899	15,628	77,163	27,066	18,486	8,580
1991	9,409	85,811	20,712	12,053	128,784	15,932	79,637	29,628	20,919	8,709
1992	9,409	96,225	20,712	12,053	128,784	15,932	178,674	30,084	20,919	9,165

EU = European Union; EFTA = European Free Trade Association; NA = not available

NOTES: Data are compiled from numerous national and international sources, and degree fields may not be strictly comparable. Detailed national education data were available for Austria, France, Germany, Switzerland, the United Kingdom, and the United States. These data were reconfigured to the International Standard Classification of Instructional Programs. First university degrees in different countries are of different duration and may not be academically equivalent. Data for Germany includes East and West German data for 1990-92; prior years (1975-89) include only West German data. The Netherlands and United Kingdom data do not include open universities. See Notes on Data Series for degrees included in first university degrees.

[1] Natural sciences in this table include mathematics and computer science and agricultural sciences, as well as physical, biological, and environmental sciences. For a breakout of mathematics and computer science and agricultural science from natural sciences see appendix table 16.

[2] U.K. 1992 data contain polytechnics brought into the university system.

SOURCES: Organisation for Economic Co-operation and Development (OECD), Center for Research and Innovation (CERI) "Education at a Glance" database, 1994; United Nations Educational, Scientific, and Cultural Organization, *Statistical Yearbook,* annual series, supplemented by national sources: Austria—Population Division, Austrian Central Statistical Office, unpublished tabulations; France—Ministère de l'Education Nationale, *Repères et Références: Statistiques sur les Enseignements;* Germany—Statistisches Bundesamt Wiesbaden, *Prüfungen an Hochschulen;* Switzerland—Federal Office of Statistics, Education and Society Division, Universities and Science Section, unpublished tabulations; United Kingdom—University Grants Committee, *University Statistics,* Universities Statistical Record, and the Department of Education and Science, unpublished tabulations; United States—National Science Foundation, Science Resources Studies Division, *Science and Engineering Degrees: 1966-93,* NSF 95-312 (Arlington, VA: NSF, 1995). For additional national sources, see Contacts and References.

Appendix table 6. Population of 20- to 24-year-olds in European countries and the United States: 1975-2010 (projected)

Year	Total Europe	United States	Total EU	Austria	Belgium	Denmark	Finland	France	Germany
				In thousands					
1975	33,915	19,527	25,020	512	749	375	420	4,247	5,550
1976	34,082	20,701	25,277	527	757	374	413	4,243	5,634
1977	34,255	21,927	25,538	542	766	373	405	4,239	5,720
1978	34,434	23,210	25,804	558	774	373	398	4,236	5,807
1979	34,620	24,555	26,075	574	782	372	391	4,232	5,896
1980	34,811	21,584	26,349	590	791	371	384	4,228	5,986
1981	35,039	21,508	26,821	600	791	376	383	4,242	6,104
1982	35,287	21,433	27,303	611	792	381	382	4,255	6,223
1983	35,556	21,358	27,797	621	792	387	381	4,269	6,346
1984	35,846	21,283	28,302	632	792	392	380	4,283	6,471
1985	36,157	21,208	28,819	643	793	397	378	4,296	6,598
1986	36,107	20,700	28,721	644	782	397	374	4,294	6,537
1987	36,069	20,205	28,626	644	772	396	369	4,291	6,477
1988	36,043	19,721	28,533	645	761	396	364	4,288	6,419
1989	36,028	19,249	28,442	645	751	395	360	4,286	6,362
1990	36,123	19,149	28,494	646	730	395	354	4,306	6,356
1991	35,554	18,970	27,880	625	718	392	354	4,299	6,003
1992	34,991	18,793	27,260	604	705	389	334	4,293	5,669
1993	34,477	18,618	26,681	584	693	387	325	4,286	5,354
1994	33,989	18,444	26,126	565	682	384	316	4,280	5,056
1995	33,528	18,272	25,594	546	670	381	307	4,273	4,775
1996	33,109	18,187	25,044	530	660	369	312	4,172	4,683
1997	32,691	18,101	24,494	514	650	358	317	4,072	4,592
1998	32,273	18,016	23,944	499	640	346	322	3,971	4,500
1999	31,855	17,930	23,394	483	630	335	327	3,871	4,409
2000	31,437	17,845	22,845	467	620	323	332	3,770	4,317
2001	31,095	18,068	22,624	470	618	313	332	3,786	4,351
2002	30,754	18,292	22,403	473	616	303	332	3,802	4,386
2003	30,412	18,515	22,183	475	615	292	331	3,818	4,420
2004	30,071	18,739	21,962	478	613	282	331	3,834	4,455
2005	29,729	18,962	21,741	481	611	272	331	3,850	4,489
2006	32,690	19,038	24,795	478	607	277	327	3,852	4,540
2007	35,651	19,113	27,849	475	603	282	324	3,854	4,591
2008	38,611	19,189	30,904	472	600	286	320	3,856	4,642
2009	41,572	19,264	33,958	469	596	291	317	3,858	4,693
2010	44,533	19,340	37,012	466	592	296	313	3,860	4,744

See explanatory information and SOURCE at end of table.

Appendix table 6. Population of 20- to 24-year-olds in European countries and the United States: 1975-2010 (projected)

Year	Greece	Ireland	Italy	Nether-lands	Portugal	Spain	Sweden	U.K.
	In thousands							
1975	639	246	3,819	1,130	736	2,653	565	3,891
1976	650	250	3,863	1,144	752	2,697	563	3,937
1977	662	255	3,907	1,158	769	2,741	561	3,983
1978	673	260	3,951	1,172	785	2,786	560	4,030
1979	685	264	3,996	1,187	803	2,832	558	4,077
1980	697	269	4,042	1,201	820	2,879	556	4,125
1981	703	273	4,151	1,215	827	2,952	562	4,242
1982	708	277	4,263	1,229	834	3,027	568	4,363
1983	714	282	4,378	1,243	841	3,105	574	4,488
1984	720	286	4,496	1,257	848	3,183	580	4,615
1985	726	290	4,617	1,271	855	3,265	586	4,747
1986	735	298	4,639	1,264	854	3,267	587	4,695
1987	744	305	4,660	1,257	853	3,270	588	4,644
1988	754	313	4,682	1,249	851	3,273	589	4,593
1989	763	321	4,704	1,242	850	3,275	590	4,543
1990	780	306	4,727	1,249	825	3,302	615	4,549
1991	775	311	4,666	1,208	824	3,300	615	4,415
1992	769	317	4,605	1,169	823	3,298	602	4,286
1993	764	322	4,545	1,131	822	3,297	595	4,160
1994	759	327	4,486	1,095	821	3,295	588	4,038
1995	754	333	4,428	1,059	820	3,293	582	3,919
1996	758	333	4,273	1,032	809	3,254	568	3,819
1997	761	334	4,118	1,005	797	3,216	555	3,719
1998	765	334	3,964	979	786	3,177	541	3,620
1999	768	335	3,809	952	774	3,139	528	3,520
2000	772	335	3,654	925	763	3,100	514	3,420
2001	759	330	3,536	904	744	2,980	510	3,461
2002	746	325	3,417	883	725	2,860	506	3,502
2003	734	321	3,299	862	707	2,739	502	3,543
2004	721	316	3,180	841	688	2,619	498	3,584
2005	708	311	3,062	820	669	2,499	494	3,625
2006	682	304	3,016	848	649	2,418	506	6,768
2007	657	297	2,970	876	630	2,338	517	9,911
2008	631	289	2,924	905	610	2,257	529	13,054
2009	606	282	2,878	933	591	2,177	540	16,197
2010	580	275	2,832	961	571	2,096	552	19,340

See explanatory information and SOURCE at end of table.

Appendix table 6. Population of 20- to 24-year-olds in European countries and the United States: 1975-2010 (projected)

Year	Total EFTA	Iceland	Norway	Switzer-land	Central Europe	Bulgaria	Czecho-slovakia	Czech Rep	Slovak Rep
					In thousands				
1975	799	21	302	476	8,096	671	1,285	—	—
1976	799	21	303	474	8,007	663	1,258	—	—
1977	798	21	305	472	7,919	655	1,231	—	—
1978	798	21	306	471	7,833	647	1,204	—	—
1979	797	21	308	469	7,748	639	1,178	—	—
1980	797	21	309	467	7,665	631	1,153	—	—
1981	808	21	310	477	7,411	626	1,137	—	—
1982	818	21	310	487	7,166	620	1,121	—	—
1983	829	21	311	497	6,930	615	1,105	—	—
1984	841	21	312	508	6,703	609	1,089	—	—
1985	853	21	313	519	6,485	604	1,074	—	—
1986	854	21	317	516	6,532	599	1,074	—	—
1987	856	21	322	513	6,587	593	1,073	—	—
1988	858	21	327	510	6,652	588	1,073	—	—
1989	860	21	332	507	6,726	582	1,073	—	—
1990	862	21	339	502	6,767	572	1,073	—	—
1991	852	21	339	492	6,821	579	—	706	384
1992	836	21	333	482	6,895	587	—	731	393
1993	824	21	330	473	6,972	595	—	757	403
1994	811	21	327	463	7,052	602	—	783	412
1995	799	21	324	454	7,135	610	—	811	422
1996	780	21	314	445	7,286	612	—	825	433
1997	761	21	304	436	7,437	614	—	839	444
1998	741	21	293	427	7,587	616	—	854	454
1999	722	21	283	418	7,738	618	—	868	465
2000	703	21	273	409	7,889	620	—	882	476
2001	700	21	271	408	7,771	607	—	844	470
2002	697	21	268	407	7,654	594	—	807	464
2003	693	21	266	407	7,536	581	—	769	458
2004	690	21	263	406	7,419	568	—	732	452
2005	687	21	261	405	7,301	555	—	694	446
2006	686	21	265	401	7,208	551	—	684	439
2007	686	21	269	396	7,115	547	—	674	433
2008	685	21	272	392	7,023	543	—	664	426
2009	685	21	276	387	6,930	539	—	654	420
2010	684	21	280	383	6,837	535	—	644	413

See explanatory information and SOURCE at end of table.

Appendix table 6. Population of 20- to 24-year-olds in European countries and the United States: 1975-2010 (projected)

Year	Hungary	Poland	Romania
	In thousands		
1975	923	3,423	1,794
1976	894	3,406	1,786
1977	866	3,389	1,779
1978	838	3,372	1,771
1979	812	3,356	1,764
1980	786	3,339	1,756
1981	755	3,212	1,682
1982	725	3,090	1,610
1983	697	2,972	1,542
1984	669	2,859	1,476
1985	643	2,750	1,414
1986	655	2,691	1,513
1987	668	2,634	1,620
1988	681	2,577	1,733
1989	694	2,522	1,855
1990	686	2,463	1,973
1991	692	2,521	1,939
1992	698	2,580	1,907
1993	704	2,640	1,874
1994	710	2,702	1,842
1995	716	2,765	1,811
1996	737	2,849	1,829
1997	758	2,933	1,848
1998	780	3,018	1,866
1999	801	3,102	1,885
2000	822	3,186	1,903
2001	784	3,215	1,851
2002	746	3,244	1,799
2003	708	3,272	1,748
2004	670	3,301	1,696
2005	632	3,330	1,644
2006	620	3,251	1,662
2007	608	3,173	1,681
2008	596	3,094	1,699
2009	584	3,016	1,718
2010	572	2,937	1,736

EU = European Union; EFTA = European Free Trade Association; — = Czechoslovakia became the Czech Republic and the Slovak Republic in 1991. As a result, data for the Czech Republic and Slovak Republic are unavailable prior to 1990. Similarly, Czechoslavakia did not exist after 1990 and therefore, data are unavailable.

SOURCE: E. Bos, A. Levin, and M. T. Vu, *World Bank Population Projections,* (Washington, DC: World Bank, 1993).

Appendix table 7. Participation rate of college age cohort in first university degrees in all fields in selected European countries and the United States: 1975-92

Year	Total Europe	United States	Total EU	Austria	Belgium	Denmark	Finland	France	Germany	Greece
					Percent					
1975	6.6	23.9	6.6	4.2	NA	NA	10.5	4.2	10.7	NA
1976	7.8	22.6	7.8	5.4	10.4	15.8	14.1	4.5	10.7	10.0
1977	8.1	21.2	8.0	5.8	11.2	13.9	13.5	4.9	10.9	8.9
1978	8.2	20.0	8.2	5.9	12.4	14.3	13.2	5.2	10.5	10.9
1979	8.4	19.0	8.3	6.4	11.1	14.0	12.9	5.6	10.2	12.6
1980	8.4	21.8	8.4	7.5	10.0	13.8	12.4	6.1	10.1	10.9
1981	8.4	22.0	8.3	7.9	10.7	13.6	12.2	6.5	9.7	10.0
1982	8.6	22.5	8.5	8.3	11.5	13.4	11.3	7.0	10.4	10.4
1983	8.7	23.0	8.6	8.0	12.9	13.1	12.2	7.5	10.8	10.7
1984	8.7	23.2	8.7	7.8	12.8	11.4	13.2	7.7	11.0	10.7
1985	9.5	23.4	9.4	7.4	12.6	9.8	14.3	8.3	11.3	10.7
1986	9.6	24.2	9.6	7.7	11.1	10.4	14.9	8.5	11.2	11.0
1987	10.1	24.8	10.1	7.9	10.4	10.8	14.9	9.1	11.3	11.3
1988	10.6	25.5	10.5	7.5	11.9	10.9	17.9	9.2	11.3	11.3
1989	11.2	26.8	11.1	7.8	16.7	14.4	16.3	9.8	11.3	11.4
1990	11.9	27.7	11.8	7.7	17.2	15.5	16.5	11.2	12.3	12.3
1991	12.5	29.2	12.3	8.5	13.3	16.0	16.7	12.1	12.5	11.8
1992	13.5	30.6	14.0	8.5	13.3	16.0	16.7	13.0	12.8	11.9

See explanatory information and SOURCES at end of table.

Appendix table 7. Participation rate of college age cohort in first university degrees in all fields in selected European countries and the United States: 1975-92

Year	Ireland	Italy	Netherlands	Portugal	Spain	Sweden	U.K.[1]	Total EFTA	Norway	Switzerland
					Percent					
1975	7.7	9.2	4.8	NA	NA	10.2	7.1	NA	NA	5.4
1976	8.6	9.5	4.8	NA	4.2	13.6	7.2	NA	NA	5.7
1977	10.6	9.2	4.8	NA	4.8	13.0	7.6	NA	NA	5.9
1978	9.7	9.1	4.9	NA	5.2	12.6	7.9	NA	NA	6.1
1979	9.4	8.8	4.6	NA	7.4	12.9	8.1	NA	NA	6.3
1980	10.9	8.7	4.6	NA	8.1	14.0	8.2	NA	NA	6.4
1981	10.3	8.4	5.2	NA	8.1	15.1	8.2	NA	NA	6.4
1982	9.7	8.2	5.6	NA	8.2	16.2	8.2	NA	NA	6.4
1983	10.7	7.9	6.0	5.8	7.2	16.3	8.2	NA	NA	6.3
1984	11.7	7.8	6.2	6.3	7.8	17.9	7.9	NA	NA	6.3
1985	14.1	7.8	6.5	6.4	14.1	15.5	7.6	10.9	18.5	7.2
1986	16.0	7.9	7.0	5.5	14.9	14.1	7.6	10.6	17.0	7.3
1987	15.5	7.9	8.3	6.7	16.2	14.7	7.6	13.0	22.7	7.6
1988	15.9	8.3	11.2	6.8	17.2	14.7	7.7	13.7	23.8	7.9
1989	14.1	8.9	10.2	6.8	17.9	14.3	8.1	14.6	25.2	8.1
1990	15.5	8.9	7.9	7.0	18.5	13.4	8.5	15.7	27.3	7.7
1991	15.1	9.2	8.6	7.3	19.5	13.5	9.0	17.4	30.9	7.8
1992	15.1	10.4	8.6	7.3	19.5	13.5	20.8	16.9	30.9	8.3

EU = European Union; EFTA = European Free Trade Association; NA = not available

NOTES: The college age cohort used for most countries is the 24-year-old segment of their population; the 27-year-old segment is chosen for Finland, Germany, Sweden, and Switzerland. Data are compiled from numerous national and international sources, and degree fields may not be strictly comparable. Detailed national education data were available for Austria, France, Germany, Switzerland, and the United Kingdom. These data were reconfigured to the International Standard Classification of Instructional Programs. First university degrees in different countries are of different duration and may not be academically equivalent. Data for Germany includes East and West German data for 1990-92; prior years (1975-89) include only West German data. The Netherlands and United Kingdom data do not include open universities. See Notes on Data Series for degrees included in first university degrees.

[1] U.K. 1992 data include polytechnics brought into the university system.

SOURCES: Organisation for Economic Co-operation and Development (OECD), Center for Research and Innovation (CERI) "Education at a Glance" database, 1994; United Nations Educational, Scientific, and Cultural Organization, *Statistical Yearbook,* annual series, supplemented by national sources: Austria— Austrian Central Statistical Office, Population Division, unpublished tabulations; France—Ministère de l'Education Nationale, *Repères et Références: Statistiques sur* les Enseignements; Germany—Statistisches Bundesamt Wiesbaden, *Prüfungen an Hochschulen;* Switzerland— Federal Office of Statistics, Education and Society Division, Universities and Science Section, unpublished tabulations; United Kingdom—University Grants Committee, *University Statistics,* Universities Statistical Record. United States—National Science Foundation, Science Resources Studies Division, *Science and Engineering Degrees: 1966-93,* NSF 95-312 (Arlington, VA: NSF, 1995).

Appendix table 8. Participation rate of the college age cohort in natural sciences and engineering in selected European countries and the United States: 1975-92

Year	Total Europe	United States	Total EU	Austria	Belgium	Denmark	Finland	France	Germany	Greece
					Percent					
1975	2.0	4.0	2.0	0.7	NA	NA	2.9	2.0	3.4	0.7
1976	2.1	3.9	2.2	0.7	1.1	0.2	3.7	2.0	3.3	2.2
1977	2.3	3.7	2.3	0.7	1.3	2.1	3.3	2.0	3.5	2.0
1978	2.3	3.6	2.3	1.1	1.4	2.2	3.2	2.1	3.4	2.5
1979	2.3	3.5	2.3	1.1	1.2	2.1	3.3	2.2	3.2	2.9
1980	2.3	4.1	2.3	1.3	1.1	2.3	3.4	2.3	3.2	3.0
1981	2.4	4.2	2.4	1.2	1.2	2.4	3.5	2.3	3.3	2.9
1982	2.4	4.4	2.4	1.3	1.2	2.4	3.5	2.4	3.4	3.2
1983	2.4	4.6	2.5	1.3	1.1	2.5	3.4	2.5	3.4	3.3
1984	2.5	4.8	2.5	1.4	1.3	3.0	3.3	2.6	3.4	2.9
1985	2.5	5.0	2.6	1.3	2.2	2.5	6.0	2.8	3.5	3.1
1986	2.7	5.2	2.7	1.4	3.3	3.1	6.1	2.9	3.7	2.8
1987	2.8	5.1	2.8	1.6	3.4	3.2	5.6	3.0	3.8	2.9
1988	3.0	4.9	3.0	1.6	3.9	3.5	6.3	3.1	3.8	2.8
1989	3.1	4.8	3.1	1.9	4.1	3.9	5.2	3.3	4.1	2.8
1990	3.5	4.5	3.5	1.9	4.3	4.4	6.2	3.5	4.7	3.3
1991	3.6	4.4	3.7	2.1	4.4	4.7	6.4	3.8	4.9	3.2
1992	4.0	4.6	4.0	2.1	4.4	4.7	6.4	4.2	5.0	3.2

See explanatory information and SOURCES at end of table.

Appendix table 8. Participation rate of the college age cohort in natural sciences and engineering in selected European countries and the United States: 1975-92

Year	Ireland	Italy	Netherlands	Portugal	Spain	Sweden	U.K.[1]	Total EFTA	Norway	Switzerland
					Percent					
1975	2.0	2.3	1.6	NA	NA	2.0	2.9	NA	NA	NA
1976	2.1	2.4	1.5	NA	0.9	2.1	2.9	NA	NA	1.3
1977	2.1	2.3	1.6	NA	1.7	2.0	2.9	NA	NA	1.5
1978	2.5	2.3	1.4	NA	1.7	2.0	3.0	NA	NA	1.4
1979	2.5	2.1	1.3	NA	1.4	2.0	3.1	NA	NA	1.6
1980	2.7	2.2	1.3	NA	1.3	2.1	3.2	NA	NA	1.7
1981	2.8	2.2	1.4	NA	2.0	2.1	3.2	NA	NA	1.7
1982	2.8	2.0	1.4	NA	1.8	2.1	3.2	NA	NA	1.6
1983	4.0	2.0	1.6	NA	2.0	2.3	3.3	NA	NA	1.6
1984	4.0	1.9	1.7	NA	2.1	2.6	3.2	NA	NA	1.6
1985	4.4	1.8	1.7	1.4	2.1	2.6	3.0	1.4	1.2	1.7
1986	4.6	1.8	1.8	1.3	2.3	2.8	2.9	1.5	1.2	1.8
1987	4.7	1.8	2.4	1.4	2.4	3.4	2.9	2.2	2.9	1.9
1988	4.8	1.9	3.7	1.4	2.9	3.4	3.0	2.3	2.8	2.1
1989	4.7	2.0	2.5	1.9	3.0	3.4	3.0	2.7	3.8	2.1
1990	5.5	2.0	2.1	1.9	3.3	3.4	3.1	2.6	3.5	1.9
1991	4.5	2.1	2.3	1.9	3.5	3.4	3.2	2.8	3.8	2.0
1992	4.5	2.3	2.3	1.9	3.5	3.4	5.6	2.7	3.8	2.0

EU = European Union; EFTA = European Free Trade Association; NA = not available

NOTES: The college age cohort used for most countries is the 24-year-old segment of their population; the 27-year-old segment is chosen for Finland, Germany, Sweden, and Switzerland. Data are compiled from numerous national and international sources, and degree fields may not be strictly comparable. Detailed national education data were available for Austria, France, Germany, Switzerland, and the United Kingdom. These data were reconfigured to the International Standard Classification of Instructional Programs. First university degrees in different countries are of different duration and may not be academically equivalent. Data for Germany includes East and West German data for 1990-92; prior years (1975-89) include only West German data. The Netherlands and United Kingdom data do not include open universities.

[1] U.K. 1992 data include polytechnics brought into the university system.

SOURCES: Organisation for Economic Co-operation and Development (OECD), Center for Research and Innovation (CERI) "Education at a Glance" database, 1994; United Nations Educational, Scientific, and Cultural Organization, *Statistical Yearbook,* annual series, supplemented by national sources: Austria—Austrian Central Statistical Office, Population Division, unpublished tabulations; France—Ministère de l'Education Nationale, *Repères et Références: Statistiques sur* les Enseignements; Germany—Statistisches Bundesamt Wiesbaden, *Prüfungen an Hochschulen;* Switzerland—Federal Office of Statistics, Education and Society Division, Universities and Science Section, unpublished tabulations; United Kingdom—University Grants Committee, *University Statistics,* Universities Statistical Record. United States—National Science Foundation, Science Resources Studies Division, *Science and Engineering Degrees: 1966-93,* NSF 95-312 (Arlington, VA: NSF, 1995).

Appendix table 9. Total research and development expenditures in European countries and the United States: 1975-93
Non-defense expenditures in European countries and the United States: 1981-92

Year	Total Europe	United States	Total EU	Austria	Belgium	Denmark	Finland	France	Germany	Greece
					Millions of constant 1987 PPP dollars[1]					
Total R&D expenditures										
1975	55,139	71,600	52,130	712	1,372	553	421	10,622	15,705	0
1976	56,121	74,600	53,026	759	1,430	577	436	10,860	15,944	0
1977	57,437	76,500	54,381	812	1,492	582	461	11,079	16,357	0
1978	60,337	79,800	57,112	869	1,519	585	495	11,420	17,866	62
1979	63,573	83,700	60,445	940	1,543	596	530	12,148	19,280	104
1980	65,127	87,300	62,039	1,006	1,662	646	590	12,611	19,618	116
1981	68,902	91,100	65,823	1,069	1,767	670	641	13,923	20,029	120
1982	71,355	95,500	68,287	1,127	1,844	717	703	14,892	20,571	123
1983	72,953	102,200	69,787	1,166	1,951	767	773	15,363	20,959	151
1984	77,046	111,200	73,489	1,218	2,019	822	874	16,263	21,457	186
1985	82,813	120,600	78,854	1,249	2,092	878	958	16,922	23,651	207
1986	86,149	123,400	81,835	1,304	2,114	963	1,040	17,192	24,323	207
1987	90,595	125,400	86,150	1,329	2,167	1,036	1,132	17,874	26,018	222
1988	94,211	127,900	89,650	1,416	2,213	1,101	1,219	18,663	26,860	236
1989	98,304	129,900	93,670	1,496	2,372	1,151	1,310	19,811	27,924	312
1990	101,875	133,800	97,095	1,615	2,438	1,225	1,365	21,017	28,333	310
1991	103,816	136,100	99,022	1,757	2,452	1,297	1,376	21,113	30,383	318
1992	104,012	137,900	99,515	1,815	2,673	1,353	1,394	21,310	29,969	279
1993	103,427	137,300	98,926	1,881	2,282	1,419	1,399	21,139	29,660	287
Non-defense R&D expenditures										
1981	58,923	67,800	55,890	1,049	1,700	659	641	8,964	19,138	115
1982	61,752	69,200	58,719	1,107	1,800	691	675	9,973	19,791	115
1983	64,040	73,600	60,938	1,128	1,909	754	753	10,407	20,099	144
1984	67,077	79,000	63,584	1,191	1,961	808	836	10,963	20,638	178
1985	72,489	84,900	68,604	1,220	2,052	842	956	11,492	22,792	184
1986	75,422	85,300	71,147	1,284	2,082	945	1,008	11,624	23,300	187
1987	80,698	86,200	76,322	1,306	2,136	1,021	1,100	14,147	24,540	203
1988	84,347	89,300	79,821	1,359	2,148	1,084	1,183	14,742	25,454	231
1989	88,036	92,500	83,436	1,464	2,333	1,112	1,268	16,148	26,325	306
1990	91,716	98,500	86,940	1,588	2,404	1,211	1,315	17,384	26,712	306
1991	94,492	102,700	89,709	1,759	2,419	1,265	1,363	17,588	29,204	303
1992	95,756	104,700	91,276	1,786	2,638	1,319	1,375	17,726	28,879	274

See explanatory information and SOURCES at end of table.

Appendix table 9. Total research and development expenditures in European countries and the United States: 1975-93
Non-defense expenditures in European countries and the United States: 1981-92

Year	Ireland	Italy	Netherlands	Portugal	Spain	Sweden	U.K.	Total EFTA	Norway	Switzerland
					Millions of constant 1987 PPP dollars[1]					
Total R&D expenditures										
1975	153	4,351	3,030	73	964	1,772	12,403	3,009	744	2,265
1976	149	4,257	3,110	122	973	1,798	12,614	3,094	802	2,293
1977	154	4,442	3,050	142	1,022	1,850	12,940	3,055	859	2,196
1978	157	4,343	3,087	155	1,041	1,906	13,608	3,225	896	2,329
1979	157	4,617	3,181	172	1,096	1,988	14,095	3,128	761	2,368
1980	160	4,870	3,220	176	1,209	2,165	13,989	3,088	665	2,423
1981	174	5,767	3,177	194	1,286	2,421	14,584	3,079	690	2,389
1982	177	5,968	3,288	197	1,491	2,614	14,575	3,068	730	2,338
1983	170	6,351	3,412	216	1,494	2,775	14,238	3,166	783	2,383
1984	193	6,921	3,417	220	1,568	3,024	15,307	3,557	897	2,660
1985	214	7,933	3,739	249	1,793	3,326	15,643	3,958	999	2,960
1986	232	8,199	4,070	263	2,056	3,441	16,432	4,315	1,045	3,270
1987	245	8,884	4,309	288	2,263	3,629	16,755	4,445	1,074	3,371
1988	248	9,453	4,308	320	2,675	3,716	17,221	4,561	1,079	3,482
1989	266	9,923	4,309	373	2,946	3,745	17,734	4,634	1,101	3,533
1990	302	10,589	4,279	430	3,445	3,675	18,073	4,780	1,109	3,671
1991	359	10,919	4,139	439	3,621	3,647	17,203	4,794	1,125	3,669
1992	397	10,884	4,084	519	3,822	3,762	17,255	4,497	1,110	3,387
1993	422	10,753	4,014	536	3,621	3,823	17,691	4,502	1,221	3,281
Non-defense R&D expenditures										
1981	167	5,608	3,126	198	1,206	2,214	11,105	3,033	644	2,389
1982	171	5,753	3,253	196	1,439	2,454	11,301	3,033	694	2,339
1983	170	6,208	3,367	219	1,470	2,608	11,702	3,102	719	2,383
1984	191	6,863	3,404	221	1,523	2,823	11,985	3,493	833	2,660
1985	210	7,754	3,676	250	1,629	3,117	12,430	3,885	925	2,960
1986	227	8,069	4,012	266	2,016	3,187	12,940	4,275	1,003	3,272
1987	238	8,734	4,255	293	2,130	3,412	12,807	4,376	1,005	3,371
1988	230	9,322	4,268	325	2,614	3,488	13,374	4,526	1,044	3,482
1989	260	9,592	4,266	376	2,738	3,576	13,672	4,600	1,067	3,533
1990	298	10,464	4,221	436	3,246	3,613	13,742	4,776	1,104	3,671
1991	357	10,773	4,088	445	3,322	3,426	13,398	4,783	1,114	3,669
1992	396	10,776	4,043	508	3,759	3,555	14,241	4,481	1,103	3,377

EU = European Union; EFTA = European Free Trade Association; R&D = research and development

NOTE: Non-defense research and development expenditures are total research and development expenditures minus government research and development funds for defense purposes.

[1] Conversion of foreign currencies to U.S. dollars are calculated with the Organisation for Economic Co-operation and Development purchasing power parity exchange rates. Constant 1987 dollars are based on the U.S. Department of Commerce calendar year gross domestic product implicit price deflators.

SOURCES: National Science Foundation, Science Resources Studies Division, *National Patterns of R&D Resources:* 1994, NSF 95-304 (Arlington, VA: NSF, 1995); and Organisation for Economic Co-operation and Development. *Main Science and Technology Indicators* database.

Appendix table 10. Research and development expenditures in European countries and the United States, by performer: 1975-92

Year	Total Europe	United States	Total EU	Austria	Belgium	Denmark	Finland	France	Germany	Greece
				Millions of constant 1987 PPP dollars[1]						
				Government						
1975	11,065	11,248	10,772	60	122	133	108	2,454	2,591	NA
1976	11,088	11,268	10,774	65	144	134	113	2,433	2,742	NA
1977	11,046	10,852	10,739	70	170	133	121	2,526	2,633	NA
1978	11,498	11,426	11,180	76	160	131	130	2,672	2,758	NA
1979	12,120	11,465	11,836	83	150	131	138	2,867	2,853	87
1980	12,243	10,810	11,977	90	141	145	143	2,913	2,794	84
1981	12,749	10,830	12,486	96	130	152	144	3,286	2,744	75
1982	13,132	10,934	12,872	100	118	156	152	3,753	2,695	71
1983	13,518	12,163	13,260	102	109	160	160	4,056	2,829	79
1984	14,276	12,730	13,980	105	107	165	174	4,310	2,854	101
1985	14,475	13,727	14,157	106	115	171	191	4,281	3,051	110
1986	14,124	13,939	13,760	109	108	188	207	4,349	3,113	103
1987	14,798	13,413	14,440	108	95	201	228	4,504	3,304	108
1988	15,158	13,785	14,798	110	102	211	235	4,647	3,358	112
1989	15,815	13,975	15,448	112	145	220	242	4,735	3,602	132
1990	16,375	14,199	16,012	121	149	224	257	5,086	3,712	128
1991	16,963	13,046	16,608	132	150	230	278	4,793	4,223	128
1992	16,613	13,822	16,276	136	163	239	287	4,305	4,465	112
				Industry						
1975	33,061	49,161	30,966	362	881	244	219	6,331	9,893	NA
1976	33,970	51,620	31,856	391	944	261	226	6,562	10,101	NA
1977	35,137	53,354	33,069	426	1013	272	239	6,677	10,626	NA
1978	38,234	55,231	36,044	463	1036	285	264	6,821	12,679	NA
1979	40,262	58,271	38,106	508	1057	301	291	7,230	13,561	NA
1980	41,872	62,071	39,723	553	1147	324	323	7,611	14,346	NA
1981	43,337	65,665	41,200	597	1229	334	351	8,203	14,065	27
1982	44,927	69,988	42,793	626	1292	371	388	8,627	14,688	29
1983	45,812	74,849	43,603	645	1378	409	431	8,727	14,965	37
1984	48,710	82,198	46,172	671	1434	447	507	9,295	15,428	48
1985	53,361	89,236	50,469	685	1496	485	562	9,937	17,295	56
1986	56,536	90,633	53,344	726	1531	534	612	10,094	17,805	59
1987	59,019	92,155	55,767	753	1579	576	667	10,527	18,786	63
1988	61,572	94,215	58,296	816	1629	609	730	11,098	19,447	67
1989	64,109	93,875	60,839	876	1589	633	807	11,937	20,161	69
1990	66,206	92,408	62,843	946	1627	697	854	12,694	20,343	75
1991	66,400	86,796	63,042	1030	1630	759	784	12,984	21,056	83
1992	66,004		63,030	1063	1778	792	792	13,404	20,409	73

See explanatory information and SOURCES at end of table.

Appendix table 10. Research and development expenditures in European countries and the United States, by performer: 1975-92

Year	Ireland	Italy	Nether-lands	Portugal	Spain	Sweden	U.K.	Total EFTA	Norway	Switzer-land
					Millions of constant 1987 PPP dollars[1]					
					Government					
1975	75	975	627	NA	344	170	3,113	292	150	143
1976	71	958	647	69	348	160	2,889	315	154	160
1977	72	1,093	634	88	340	154	2,704	307	158	149
1978	68	1,047	658	103	322	158	2,898	318	178	140
1979	63	1,113	668	96	364	165	3,058	284	142	142
1980	63	1,208	686	83	382	154	3,092	266	122	144
1981	68	1,482	661	88	406	148	3,004	263	122	141
1982	69	1,474	635	86	429	146	2,988	260	131	128
1983	59	1,499	641	92	427	142	2,905	258	136	122
1984	62	1,723	659	91	408	143	3,077	296	151	146
1985	60	1,896	684	96	434	146	2,816	318	144	174
1986	56	1,804	700	95	512	148	2,268	364	158	206
1987	55	2,008	745	99	570	152	2,262	357	170	188
1988	53	2,061	741	106	621	150	2,290	360	189	171
1989	47	2,133	746	108	669	146	2,412	367	214	153
1990	45	2,213	774	109	734	147	2,313	364	212	152
1991	49	2,347	811	104	771	150	2,443	356	211	144
1992	52	2,231	800	114	764	156	2,450	338	211	127
					Industry					
1975	47	2,424	1,624	NA	546	1,157	7,239	2,095	357	1,737
1976	47	2,330	1,642	26	559	1,206	7,560	2,114	381	1,733
1977	50	2,380	1,577	24	548	1,274	7,964	2,067	404	1,663
1978	54	2,380	1,590	20	549	1,300	8,601	2,190	420	1,770
1979	58	2,694	1,638	33	547	1,344	8,843	2,156	376	1,780
1980	64	2,875	1,662	50	635	1,421	8,712	2,148	338	1,810
1981	76	3,251	1,694	58	585	1,542	9,188	2,138	365	1,773
1982	77	3,388	1,697	62	727	1,676	9,146	2,135	399	1,736
1983	79	3,626	1,829	66	723	1,790	8,899	2,209	438	1,771
1984	95	3,902	1,838	65	812	2,003	9,628	2,538	532	2,006
1985	111	4,518	2,101	69	990	2,262	9,902	2,892	626	2,266
1986	124	4,784	2,381	69	1,147	2,319	11,157	3,192	651	2,541
1987	132	5,081	2,551	73	1,245	2,424	11,310	3,252	666	2,586
1988	138	5,464	2,585	79	1,520	2,456	11,659	3,277	639	2,638
1989	155	5,834	2,551	94	1,658	2,449	12,024	3,269	623	2,646
1990	181	6,173	2,405	112	1,991	2,454	12,290	3,363	617	2,746
1991	223	6,387	2,202	104	2,028	2,487	11,285	3,359	614	2,745
1992	248	6,444	2,124	112	1,930	2,579	11,285	2,973	600	2,374

See explanatory information and SOURCES at end of table.

Appendix table 10. Research and development expenditures in European countries and the United States, by performer: 1975-92

Year	Total Europe	United States	Total EU	Austria	Belgium	Denmark	Finland	France	Germany	Greece
					Millions of constant 1987 PPP dollars[1]					
					University					
1975	10,167	9,236	9,590	266	360	169	90	1,696	3,139	NA
1976	10,218	9,523	9,606	278	327	177	92	1,711	3,103	NA
1977	10,270	9,839	9,621	291	297	170	96	1,721	3,045	NA
1978	10,432	10,641	9,730	304	314	162	97	1,766	3,007	NA
1979	10,581	11,306	9,924	322	330	158	97	1,880	2,979	15
1980	10,878	11,789	10,223	337	346	172	119	1,943	3,036	16
1981	11,966	11,996	11,291	351	358	179	142	2,286	3,116	17
1982	12,379	11,725	11,747	376	364	183	158	2,374	3,065	23
1983	12,688	12,205	12,071	394	375	192	177	2,434	3,081	35
1984	13,083	12,948	12,456	419	392	203	188	2,497	3,068	42
1985	13,719	14,007	13,078	436	391	214	200	2,545	3,198	47
1986	14,289	15,265	13,644	444	391	232	215	2,586	3,329	45
1987	15,548	16,360	14,821	441	409	248	233	2,681	3,799	51
1988	16,209	17,372	15,368	459	403	269	249	2,762	3,922	57
1989	17,168	18,250	16,201	485	610	285	253	2,952	4,021	110
1990	18,011	18,789	17,000	523	633	289	255	3,068	4,165	107
1991	19,158	19,434	18,127	569	642	293	304	3,188	4,952	107
1992	19,950	20,275	18,805	588	700	306	307	3,303	4,975	94
					Private nonprofit					
1975	723	2,593	697	NA	10	5	0	142	79	0
1976	753	2,631	726	NA	15	5	0	153	80	0
1977	762	2,674	735	NA	12	5	0	155	82	0
1978	768	2,773	740	NA	10	5	0	160	89	0
1979	799	3,040	772	NA	6	5	0	171	96	0
1980	795	2,999	767	NA	28	6	0	144	98	0
1981	858	2,915	852	25	50	6	4	153	100	0
1982	886	2,894	836	25	57	6	5	134	103	0
1983	962	3,068	880	25	90	6	5	138	105	0
1984	1,054	3,297	964	25	87	7	6	163	107	0
1985	1,268	3,628	1,167	25	84	7	5	169	95	0
1986	1,214	3,457	1,099	25	80	10	5	155	97	0
1987	1,218	3,425	1,137	24	82	11	3	161	130	0
1988	1,250	3,441	1,191	24	82	12	5	168	134	0
1989	1,236	3,733	1,197	24	28	13	7	178	140	0
1990	1,300	4,108	1,256	26	29	15	8	168	113	0
1991	1,308	4,414	1,264	28	29	16	10	169	122	0
1992	1,447	4,756	1,395	29	32	16	10	277	120	0

See explanatory information and SOURCES at end of table.

Appendix table 10. Research and development expenditures in European countries and the United States, by performer: 1975-92

Year	Ireland	Italy	Nether-lands	Portugal	Spain	Sweden	U.K.	Total EFTA	Norway	Switzer-land
					Millions of constant 1987 PPP dollars[1]					
					University					
1975	25	953	709	0	69	439	1,675	577	233	344
1976	25	968	750	21	60	427	1,669	612	261	351
1977	26	968	762	25	123	420	1,677	649	291	358
1978	28	914	766	28	170	446	1,728	702	292	410
1979	29	808	792	32	185	479	1,818	657	238	419
1980	27	786	754	35	238	582	1,832	654	199	455
1981	28	1,033	737	39	295	726	1,983	675	200	475
1982	28	1,108	875	41	334	787	2,033	631	196	435
1983	30	1,224	863	49	344	838	2,036	617	203	415
1984	33	1,298	840	54	348	870	2,204	627	209	418
1985	41	1,521	867	68	369	911	2,268	641	222	420
1986	48	1,613	895	79	382	968	2,416	645	227	419
1987	54	1,794	922	98	428	1,049	2,614	728	228	500
1988	53	1,922	892	111	514	1,105	2,652	841	243	598
1989	60	1,965	922	132	601	1,146	2,660	967	264	703
1990	71	2,192	1,005	155	703	1,068	2,765	1,011	281	731
1991	81	2,195	1,022	158	804	1,007	2,804	1,030	300	730
1992	91	2,210	1,050	227	1,104	1,021	2,830	1,145	300	846
					Private nonprofit					
1975	2	0	85	3	0	0	372	26	4	23
1976	2	0	87	5	0	0	378	27	4	23
1977	2	0	85	6	0	0	388	26	4	22
1978	2	0	86	6	0	0	381	28	4	23
1979	2	0	89	7	0	0	395	27	4	24
1980	2	0	90	7	0	0	392	28	3	24
1981	2	0	89	8	0	7	408	6	3	2
1982	2	0	82	8	0	6	408	50	4	47
1983	2	0	82	9	0	6	413	82	5	76
1984	2	0	79	10	0	6	472	90	5	85
1985	3	0	86	15	0	7	673	102	7	95
1986	3	0	94	20	14	5	592	115	10	105
1987	3	0	90	23	18	4	586	81	11	71
1988	4	0	90	27	21	4	620	59	11	48
1989	4	0	90	38	15	4	656	39	11	28
1990	5	0	94	53	17	4	723	44	11	33
1991	6	0	103	54	18	4	705	44	11	33
1992	7	0	102	67	23	5	707	52	11	41

EU = European Union; EFTA = European Free Trade Association; NA = not available

[1] Conversion of foreign currencies to U.S. dollars are calculated with the Organisation for Economic Co-operation and Development purchasing power parity (PPP) exchange rates. Constant 1987 dollars are based on the U.S. Department of Commerce calendar year gross domestic product implicit price deflators.

SOURCES: National Science Foundation, Science Resources Studies Division, *National Patterns of R&D Resources: 1994,* NSF 95-304 (Arlington, VA: NSF, 1995); and Organisation for Economic Co-operation and Development. *Main Science and Technology Indicators* database.

Appendix table 11. Research and development expenditures in European countries and the United States, by source of funds: 1975-92

Year	Total Europe	United States	Total EU	Austria	Belgium	Denmark	Finland	France	Germany	Greece
					Millions of constant 1987 PPP dollars[1]					
Government										
1975	26,767	37,396	25,933	366	565	309	204	5,757	7,478	NA
1976	26,819	38,464	25,922	384	552	323	208	5,625	7,512	NA
1977	26,980	38,793	25,989	404	540	314	216	5,739	7,263	NA
1978	27,968	39,819	26,870	426	516	310	229	6,018	7,696	NA
1979	28,658	41,167	27,640	453	491	309	242	6,111	8,057	100
1980	29,418	41,393	28,438	478	535	342	263	6,482	8,109	101
1981	31,828	42,629	30,838	500	575	358	280	7,435	8,230	94
1982	33,122	43,702	32,171	547	606	369	301	8,042	8,487	93
1983	33,482	46,881	32,541	562	649	382	324	8,262	8,199	113
1984	34,531	50,187	33,502	596	639	393	358	8,735	8,193	139
1985	35,808	55,245	34,696	598	658	408	385	8,953	8,738	154
1986	36,593	55,966	35,389	637	604	443	409	9,023	8,632	154
1987	37,852	57,912	36,599	642	595	475	433	9,241	9,070	158
1988	38,084	57,386	36,777	659	588	503	449	9,308	9,227	160
1989	39,171	55,275	37,813	647	759	523	461	9,528	9,522	214
1990	40,843	54,587	39,444	721	771	518	519	10,142	9,661	196
1991	41,819	51,407	40,420	822	767	515	564	10,373	11,062	181
1992	40,992	50,002	39,608	841	837	537	563	9,440	11,077	161
Industry										
1975	25,447	32,162	23,545	336	744	225	209	4,143	7,904	NA
1976	26,475	33,837	24,562	362	810	237	220	4,507	8,104	NA
1977	27,713	35,117	25,712	391	881	246	238	4,553	8,676	NA
1978	30,000	37,234	27,934	422	937	252	258	4,854	9,785	NA
1979	32,555	39,763	30,497	461	994	262	280	5,236	10,904	4
1980	33,644	43,118	31,572	498	1,071	279	317	5,511	11,252	15
1981	35,242	45,563	33,171	535	1,139	286	351	5,694	11,708	26
1982	36,711	48,559	34,617	545	1,188	317	393	6,194	12,002	30
1983	37,923	51,896	35,726	568	1,258	350	439	6,450	12,616	37
1984	40,271	57,368	37,773	585	1,330	389	503	6,686	13,078	47
1985	43,966	61,418	41,129	611	1,385	429	560	7,007	14,715	53
1986	45,302	63,009	42,189	627	1,456	463	617	7,081	15,430	48
1987	48,304	62,643	45,154	646	1,524	493	677	7,471	16,623	52
1988	51,101	65,492	47,940	715	1,577	519	746	8,077	17,185	56
1989	53,048	69,169	49,914	790	1,516	538	813	8,696	17,676	60
1990	54,373	73,604	51,124	840	1,715	604	809	9,134	17,935	64
1991	55,477	78,652	52,047	889	1,589	667	777	9,034	18,746	68
1992	55,131	81,641	52,361	931	1,732	695	787	9,322	18,011	61

See explanatory information and SOURCES at end of table.

Appendix table 11. Research and development expenditures in European countries and the United States, by source of funds: 1975-92

Year	Total Europe	United States	Total EU	Austria	Belgium	Denmark	Finland	France	Germany	Greece
					Millions of constant 1987 PPP dollars[1]					
Other national sources										
1975	296	2,679	282	0	66	8	4	47	25	0
1976	319	2,740	304	0	68	8	4	43	26	0
1977	365	2,810	348	0	71	8	4	44	53	0
1978	341	3,018	323	0	73	8	5	34	58	0
1979	337	3,140	323	0	74	8	5	49	31	0
1980	328	3,147	315	0	79	9	6	38	32	0
1981	449	3,214	435	9	84	19	6	84	26	0
1982	472	3,281	472	10	88	21	7	89	27	0
1983	520	3,507	508	10	93	27	8	108	27	0
1984	527	3,648	513	8	96	30	9	114	24	0
1985	666	3,937	652	8	100	32	10	135	23	0
1986	930	4,344	915	8	88	45	11	120	28	0
1987	1,016	4,820	999	9	91	56	12	107	34	0
1988	1,089	5,112	1,071	9	92	65	14	112	44	0
1989	1,162	5,581	1,127	10	99	75	17	119	45	5
1990	1,353	5,944	1,314	11	169	80	18	147	46	12
1991	1,364	6,326	1,321	12	132	84	18	149	49	33
1992	1,548	6,456	1,503	12	144	88	20	277	48	29
Financed abroad										
1975	1,690	0	1,680	0	19	6	4	531	237	0
1976	1,777	0	1,766	60	20	6	4	543	240	0
1977	1,873	0	1,861	32	21	6	5	554	329	0
1978	1,831	0	1,818	52	21	6	5	571	359	0
1979	1,618	0	1,607	23	22	6	5	607	291	0
1980	1,610	0	1,601	25	23	6	6	631	296	0
1981	2,389	0	2,380	27	25	14	6	710	202	0
1982	2,167	0	2,151	27	26	15	7	551	218	0
1983	2,041	0	2,024	28	27	16	7	553	232	0
1984	1,821	0	1,801	29	24	17	8	732	249	0
1985	2,967	0	2,946	31	21	18	9	812	286	0
1986	3,437	0	3,417	31	29	23	9	962	306	5
1987	3,601	0	3,583	32	24	28	1	1,055	340	10
1988	3,973	0	3,952	32	22	32	4	1,157	459	20
1989	4,861	0	4,779	48	64	36	12	1,466	586	36
1990	5,549	0	5,448	50	69	47	15	1,575	595	47
1991	5,730	0	5,609	51	74	57	18	1,701	577	62
1992	5,749	0	5,629	53	80	60	21	1,854	659	56

See explanatory information and SOURCES at end of table.

Appendix table 11. Research and development expenditures in European countries and the United States, by source of funds: 1975-92

Year	Ireland	Italy	Nether-lands	Portugal	Spain	Sweden	U.K.	Total EFTA	Norway	Switzer-land
					Millions of constant 1987 PPP dollars[1]					
Government										
1975	94	1,873	1,360	NA	412	730	6,784	834	440	394
1976	91	1,939	1,418	90	407	727	6,647	897	484	413
1977	91	2,121	1,433	118	447	734	6,569	991	530	461
1978	92	2,096	1,470	135	501	729	6,654	1,097	562	536
1979	89	2,025	1,527	118	549	733	6,836	1,018	455	563
1980	90	2,204	1,539	121	588	856	6,729	981	391	590
1981	99	2,721	1,507	128	721	1,026	7,164	990	395	595
1982	101	2,892	1,601	126	787	1,068	7,151	951	396	555
1983	88	3,328	1,616	139	789	1,094	6,995	942	403	538
1984	94	3,656	1,606	141	789	1,146	7,016	1,029	432	597
1985	99	4,095	1,659	162	856	1,213	6,717	1,112	453	659
1986	102	4,529	1,791	173	991	1,264	6,637	1,204	481	723
1987	103	4,792	1,909	193	1,146	1,342	6,501	1,253	503	751
1988	98	4,895	1,840	218	1,306	1,395	6,131	1,307	526	781
1989	90	4,907	1,802	246	1,380	1,432	6,302	1,357	559	798
1990	91	5,433	1,926	275	1,554	1,348	6,289	1,399	562	837
1991	101	5,088	1,851	275	1,659	1,280	5,883	1,399	562	837
1992	89	4,865	1,862	310	1,918	1,328	5,780	1,384	547	837
Industry										
1975	49	2,217	1,506	NA	509	966	4,738	1,902	276	1,626
1976	48	2,109	1,521	26	520	1,009	5,089	1,913	292	1,621
1977	51	2,099	1,461	19	515	1,068	5,514	2,001	307	1,693
1978	53	2,170	1,454	20	495	1,110	6,124	2,066	296	1,770
1979	55	2,523	1,504	47	548	1,168	6,512	2,058	287	1,771
1980	58	2,535	1,456	51	555	1,231	6,743	2,071	255	1,816
1981	66	2,889	1,398	60	551	1,332	7,135	2,071	277	1,794
1982	67	2,892	1,482	61	683	1,480	7,282	2,094	311	1,783
1983	72	2,864	1,589	68	688	1,618	7,109	2,198	354	1,844
1984	84	3,006	1,658	70	767	1,803	7,767	2,498	426	2,072
1985	99	3,533	1,941	74	847	2,029	7,847	2,836	516	2,321
1986	112	3,301	2,129	73	1,013	2,085	7,754	3,114	532	2,581
1987	119	3,701	2,232	81	1,059	2,182	8,294	3,150	540	2,609
1988	125	4,148	2,302	90	1,271	2,206	8,923	3,161	516	2,644
1989	147	4,599	2,306	105	1,410	2,202	9,056	3,134	502	2,632
1990	178	4,629	2,183	120	1,634	2,188	9,091	3,249	498	2,751
1991	213	5,243	2,110	102	1,746	2,193	8,670	3,429	505	2,924
1992	256	5,605	2,042	104	1,670	2,276	8,869	2,770	493	2,277

See explanatory information and SOURCES at end of table.

Appendix table 11. Research and development expenditures in European countries and the United States, by source of funds: 1975-92

Year	Ireland	Italy	Nether-lands	Portugal	Spain	Sweden	U.K.	Total EFTA	Norway	Switzer-land
					Millions of constant 1987 PPP dollars[1]					
					Other national sources					
1975	0	0	10	36	22	29	35	15	15	0
1976	0	0	11	60	22	29	31	16	16	0
1977	0	0	10	70	23	31	32	17	17	0
1978	0	0	11	57	24	31	22	18	18	0
1979	0	0	11	64	25	33	23	15	15	0
1980	0	0	11	65	27	36	12	13	13	0
1981	0	0	14	96	42	19	35	14	14	0
1982	0	0	17	117	40	22	33	0	0	0
1983	0	0	16	127	38	22	31	12	12	0
1984	0	0	19	128	48	24	13	14	14	0
1985	0	0	19	173	62	54	35	14	14	0
1986	0	0	20	218	64	277	35	15	15	0
1987	1	0	30	182	67	373	39	17	17	0
1988	1	0	24	154	74	441	41	18	18	0
1989	1	0	25	300	79	310	44	35	20	15
1990	1	0	25	351	97	310	48	39	20	19
1991	1	0	27	318	121	327	51	43	21	23
1992	1	0	25	334	126	344	56	45	20	25
					Financed abroad					
1975	7	217	121	2	13	27	496	10	10	0
1976	7	213	124	4	13	27	505	11	11	0
1977	7	222	122	4	13	28	518	12	12	0
1978	8	87	123	NA	14	29	544	13	13	0
1979	8	46	127	5	14	30	423	11	11	0
1980	8	146	129	4	16	33	280	9	9	0
1981	8	156	166	6	14	36	1,009	10	10	0
1982	9	179	172	7	19	39	883	16	16	0
1983	9	159	171	6	16	42	757	17	17	0
1984	13	249	117	5	11	41	306	20	20	0
1985	14	285	98	7	86	40	1,240	21	21	0
1986	15	360	90	8	35	48	1,495	20	20	0
1987	18	382	86	8	34	58	1,508	18	18	0
1988	20	397	99	9	67	60	1,576	21	21	0
1989	22	406	129	9	139	60	1,765	82	25	57
1990	26	508	90	20	234	57	2,115	100	36	64
1991	37	625	82	36	203	54	2,030	122	52	70
1992	39	414	102	78	210	71	1,933	120	55	64

EU = European Union; EFTA = European Free Trade Association; NA = not available

[1] Conversion of foreign currencies to U.S. dollars are calculated with the Organisation for Economic Co-operation and Development purchasing power parity (PPP) exchange rates. Constant 1987 dollars are based on the U.S. Department of Commerce calendar year gross domestic product implicit price deflators.

SOURCES: National Science Foundation, Science Resources Studies Division, *National Patterns of R&D Resources: 1994*, NSF 95-304 (Arlington, VA: NSF, 1995); and Organisation for Economic Co-operation and Development. *Main Science and Technology Indicators* database.

Appendix table 12. Estimated full-time equivalent scientists and engineers employed in research and development and total labor force in Western European countries and the United States: 1975-91

Year	Total Europe	United States	Total EU	Austria	Belgium	Denmark	Finland	France	Germany	Greece
					In thousands					
FTE scientists and engineers										
1975	374.3	527.4	357.9	5.4	9.2	5.1	6.0	65.3	103.7	2.5
1976	385.4	535.2	368.7	5.6	9.2	5.3	6.3	67.0	107.3	2.6
1977	399.2	560.6	381.0	5.8	9.2	5.5	6.6	68.0	111.0	2.6
1978	411.4	586.6	393.7	6.0	10.1	5.7	7.0	70.4	113.9	2.6
1979	430.1	614.5	412.3	6.2	11.1	6.0	7.4	72.9	116.9	2.6
1980	451.2	651.1	432.5	6.5	11.9	6.4	7.8	79.2	120.7	2.7
1981	482.2	683.3	462.9	6.7	12.7	6.8	8.3	85.5	124.7	2.8
1982	504.5	711.9	484.4	6.9	13.4	7.3	8.9	90.1	127.7	2.9
1983	528.0	751.7	506.8	7.1	13.4	7.7	9.4	92.7	130.8	3.1
1984	551.9	797.8	529.3	7.4	13.9	8.1	9.7	98.2	137.1	3.3
1985	577.9	801.9	554.0	7.6	14.8	8.6	10.0	102.3	143.6	3.7
1986	607.7	838.9	582.2	7.9	15.7	9.2	10.3	105.0	154.2	4.0
1987	633.4	877.8	607.3	8.2	16.0	9.8	10.6	109.4	165.6	4.4
1988	661.4	900.7	635.1	8.5	16.6	10.4	11.4	115.2	170.9	4.8
1989	681.0	924.2	654.6	8.8	17.6	11.0	12.2	120.4	176.4	5.3
1990	701.3	942.1	674.3	8.0	18.5	11.5	13.1	123.9	183.7	5.7
1991	710.3	960.4	682.6	8.0	18.5	12.0	14.0	129.2	191.3	6.2
Labor force										
1975	144,433	95,453	129,775	3,231	3,999	2,486	2,302	22,353	26,884	3,273
1976	145,243	97,826	130,448	3,249	4,030	2,495	2,404	22,605	26,651	3,298
1977	146,172	100,665	131,298	3,273	4,056	2,538	2,405	22,910	26,577	3,318
1978	146,976	103,882	131,984	3,289	4,081	2,578	2,404	23,062	26,692	3,337
1979	148,516	106,559	133,360	3,307	4,140	2,631	2,432	23,243	26,923	3,375
1980	150,043	108,544	134,714	3,316	4,156	2,662	2,473	23,369	27,217	3,451
1981	151,151	110,315	135,674	3,336	4,173	2,674	2,506	23,530	27,416	3,680
1982	152,981	111,872	137,398	3,304	4,120	2,700	2,542	23,743	28,558	3,717
1983	153,776	113,226	138,134	3,294	4,138	2,732	2,557	23,714	28,605	3,842
1984	155,151	115,241	139,347	3,363	4,132	2,720	2,575	23,867	28,659	3,868
1985	156,331	117,167	140,384	3,355	4,112	2,753	2,596	23,917	28,897	3,892
1986	157,558	119,540	141,513	3,385	4,109	2,816	2,596	23,999	29,188	3,888
1987	159,581	121,602	143,382	3,427	4,115	2,831	2,583	24,109	29,386	3,884
1988	161,071	123,378	144,781	3,430	4,127	2,881	2,574	24,169	29,607	3,961
1989	161,991	125,557	145,613	3,450	4,144	2,879	2,583	24,297	29,799	3,967
1990	163,675	126,424	147,143	3,526	4,179	2,912	2,576	24,414	30,378	4,000
1991	172,841	126,867	156,252	3,607	4,210	2,912	2,559	24,619	39,000	4,053

See explanatory information and SOURCE at end of table.

Appendix table 12. Estimated full-time equivalent scientists and engineers employed in research and development and total labor force in Western European countries and the United States: 1975-91

Year	Ireland	Italy	Nether-lands	Portugal	Spain	Sweden	U.K.	Total EFTA	Norway	Switzer-land
					In thousands					
FTE scientists and engineers										
1975	2.5	37.9	15.5	1.7	9.0	14.8	79.3	16.4	5.8	10.6
1976	2.6	37.9	16.4	1.8	10.2	14.9	81.6	16.8	6.1	10.7
1977	2.7	39.7	17.4	1.9	11.5	15.1	84.0	18.2	6.3	11.8
1978	2.7	40.8	17.9	2.1	13.1	14.9	86.5	17.7	6.5	11.3
1979	2.6	46.4	18.5	2.3	13.5	14.8	91.2	17.8	7.1	10.7
1980	2.6	47.0	18.9	2.7	13.7	16.3	96.1	18.7	7.4	11.2
1981	2.6	52.1	19.4	2.8	19.3	17.9	101.2	19.3	7.5	11.8
1982	2.8	56.7	20.7	3.0	18.8	18.5	106.7	20.1	7.8	12.3
1983	3.2	63.0	22.0	3.2	19.5	19.2	112.4	21.2	8.3	12.9
1984	3.6	62.0	23.1	3.5	20.5	20.5	118.4	22.5	9.0	13.6
1985	3.7	63.8	24.2	3.9	21.2	21.9	124.8	23.9	9.7	14.2
1986	3.9	67.8	24.8	4.5	24.5	22.3	128.2	25.5	10.5	14.9
1987	5.1	70.6	25.5	4.7	26.5	22.7	128.2	26.2	11.5	14.7
1988	6.4	74.8	26.1	5.0	31.2	23.9	130.0	26.3	11.8	14.5
1989	6.7	76.1	26.7	5.4	32.9	25.1	130.0	26.4	12.2	14.3
1990	7.1	77.9	26.0	5.9	37.7	25.2	130.0	27.1	12.8	14.3
1991	7.7	75.2	26.0	5.9	37.0	25.4	126.0	27.8	13.5	14.3
Labor force										
1975	1,157	21,233	5,003	4,030	13,464	4,129	25,893	14,658	1,772	3,129
1976	1,169	21,553	5,033	4,121	13,382	4,155	26,111	14,795	1,844	3,044
1977	1,188	21,870	5,072	4,165	13,380	4,174	26,224	14,874	1,876	3,047
1978	1,209	21,950	5,132	4,177	13,409	4,209	26,357	14,992	1,911	3,077
1979	1,233	22,276	5,207	4,274	13,431	4,268	26,627	15,156	1,937	3,109
1980	1,247	22,553	5,403	4,361	13,456	4,318	26,839	15,329	1,940	3,176
1981	1,272	22,693	5,660	4,334	13,502	4,332	26,740	15,477	1,975	3,217
1982	1,296	22,798	5,774	4,330	13,685	4,357	26,677	15,583	1,995	3,270
1983	1,307	23,061	5,729	4,555	13,841	4,375	26,610	15,642	2,014	3,286
1984	1,307	23,323	5,773	4,529	13,904	4,391	27,265	15,804	2,034	3,323
1985	1,302	23,495	5,812	4,514	13,976	4,424	27,714	15,947	2,068	3,382
1986	1,308	23,851	5,863	4,520	14,180	4,386	27,791	16,045	2,128	3,424
1987	1,319	24,030	6,486	4,567	14,676	4,421	27,979	16,199	2,171	3,465
1988	1,310	24,242	6,641	4,616	14,972	4,471	28,255	16,290	2,183	3,503
1989	1,292	24,258	6,713	4,677	15,160	4,527	28,427	16,378	2,155	3,535
1990	1,305	24,515	6,872	4,756	15,333	4,577	28,479	16,532	2,142	3,583
1991	1,334	24,598	7,011	4,869	15,382	4,552	28,264	16,589	2,126	3,602

See explanatory information and SOURCE at end of table.

Appendix table 12. Estimated full-time equivalent scientists and engineers employed in research and development and total labor force in Western European countries and the United States: 1975-91

Year	Total Europe	United States	Total EU	Austria	Belgium	Denmark	Finland	France	Germany	Greece
				FTE scientists and engineers per 10,000 in labor force						
1975	25.9	55.3	27.6	16.7	23.0	20.7	26.1	29.2	38.6	7.6
1976	26.5	54.7	28.3	17.2	22.9	21.3	26.3	29.6	40.3	7.8
1977	27.3	55.7	29.0	17.7	22.8	21.6	27.6	29.7	41.8	7.8
1978	28.0	56.5	29.8	18.3	24.8	22.2	29.1	30.5	42.7	7.8
1979	29.0	57.7	30.9	18.9	26.8	22.8	30.4	31.4	43.4	7.8
1980	30.1	60.0	32.1	19.5	28.6	24.0	31.7	33.9	44.4	7.9
1981	31.9	61.9	34.1	20.1	30.5	25.4	33.3	36.3	45.5	7.7
1982	33.0	63.6	35.3	21.0	32.5	26.9	34.9	37.9	44.7	7.9
1983	34.3	66.4	36.7	21.7	32.5	28.1	36.8	39.1	45.7	7.9
1984	35.6	69.2	38.0	21.9	33.7	29.9	37.7	41.1	47.8	8.6
1985	37.0	68.4	39.5	22.7	35.9	31.1	38.5	42.8	49.7	9.4
1986	38.6	70.2	41.1	23.3	38.2	32.6	39.6	43.7	52.8	10.3
1987	39.7	72.2	42.4	23.9	39.0	34.5	41.0	45.4	56.4	11.4
1988	41.1	73.0	43.9	24.7	40.3	36.0	44.1	47.6	57.7	12.2
1989	42.0	73.6	45.0	25.5	42.4	38.1	47.2	49.6	59.2	13.4
1990	42.8	74.5	45.8	22.7	44.2	39.5	50.8	50.8	60.5	14.4
1991	41.1	75.7	43.7	22.2	43.9	41.4	54.8	52.5	49.1	15.4

See explanatory information and SOURCE at end of table.

Appendix table 12. Estimated full-time equivalent scientists and engineers employed in research and development and total labor force in Western European countries and the United States: 1975-91

Year	Ireland	Italy	Nether-lands	Portugal	Spain	Sweden	U.K.	Total EFTA	Norway	Switzer-land
					FTE scientists and engineers per 10,000 in labor force					
1975	21.3	17.9	30.9	4.2	6.7	35.7	30.6	11.2	32.9	33.8
1976	22.0	17.6	32.6	4.3	7.6	35.9	31.3	11.3	32.9	35.1
1977	22.6	18.2	34.2	4.6	8.6	36.2	32.0	12.2	33.7	38.8
1978	21.9	18.6	34.9	4.9	9.7	35.5	32.8	11.8	33.8	36.6
1979	21.2	20.8	35.4	5.5	10.0	34.6	34.2	11.7	36.5	34.5
1980	21.1	20.8	35.0	6.1	10.2	37.6	35.8	12.2	38.3	35.4
1981	20.7	22.9	34.3	6.5	14.3	41.3	37.9	12.5	38.0	36.6
1982	21.4	24.9	35.8	7.0	13.7	42.5	40.0	12.9	38.9	37.8
1983	24.7	27.3	38.5	7.1	14.1	43.8	42.2	13.6	41.1	39.4
1984	27.7	26.6	40.0	7.7	14.7	46.7	43.4	14.3	44.1	40.8
1985	28.7	27.1	41.6	8.7	15.2	49.5	45.0	15.0	46.9	42.1
1986	29.5	28.4	42.3	9.9	17.3	50.9	46.1	15.9	49.5	43.5
1987	38.7	29.4	39.3	10.4	18.0	51.4	45.8	16.1	52.8	42.4
1988	48.5	30.9	39.3	10.8	20.8	53.4	46.0	16.1	54.1	41.3
1989	52.1	31.4	39.7	11.6	21.7	55.4	45.7	16.1	56.4	40.3
1990	54.4	31.8	37.8	12.4	24.6	55.2	45.6	16.4	59.7	39.9
1991	57.6	30.6	37.1	12.1	24.1	55.8	44.6	16.7	63.3	39.7

EU = European Union; EFTA = European Free Trade Association; FTE = full-time equivalent

SOURCE: Organisation for Economic Co-operation and Development (OECD), *Main Science and Technology Indicators,* Paris, 1994.

Appendix table 13. Total population in European countries and the United States: 1975-2000 (projected)

Year	Total Europe	United States	Total EU	Austria	Belgium	Denmark	Finland	France	Germany
					In thousands				
1975	449,375	215,972	349,411	7,521	9,796	5,088	4,712	52,699	78,680
1976	451,042	218,279	350,422	7,527	9,811	5,104	4,726	52,909	78,358
1977	452,567	220,611	351,286	7,533	9,822	5,117	4,739	53,145	78,205
1978	454,530	222,968	352,582	7,539	9,830	5,125	4,752	53,376	78,109
1979	456,365	225,350	353,745	7,545	9,837	5,122	4,766	53,606	78,119
1980	458,202	227,757	354,904	7,551	9,851	5,119	4,779	53,881	78,305
1981	459,968	230,017	356,157	7,541	9,853	5,114	4,803	54,182	78,401
1982	461,286	232,299	356,958	7,531	9,856	5,112	4,828	54,480	78,338
1983	462,510	234,604	357,661	7,521	9,855	5,114	4,852	54,729	78,104
1984	463,659	236,932	358,286	7,512	9,855	5,121	4,877	54,947	77,838
1985	464,883	239,283	358,982	7,502	9,862	5,127	4,901	55,170	77,668
1986	466,122	241,241	359,824	7,500	9,870	5,126	4,916	55,394	77,711
1987	467,522	243,215	360,824	7,498	9,885	5,124	4,931	55,630	77,845
1988	468,903	245,206	361,803	7,496	9,899	5,123	4,945	55,831	78,205
1989	470,291	247,212	362,787	7,494	9,910	5,121	4,960	56,032	78,567
1990	471,818	249,235	363,907	7,492	9,938	5,120	4,975	56,173	79,484
1991	473,056	251,952	365,315	7,588	9,965	5,139	5,001	56,558	79,806
1992	474,382	254,699	366,734	7,684	9,991	5,157	5,027	56,946	80,130
1993	475,723	257,475	368,164	7,782	10,018	5,176	5,053	57,336	80,455
1994	477,080	260,282	369,605	7,881	10,044	5,195	5,079	57,729	80,781
1995	478,452	263,119	371,056	7,981	10,071	5,214	5,105	58,125	81,109
1996	479,196	265,576	371,703	8,012	10,082	5,225	5,121	58,383	81,107
1997	479,944	268,056	372,353	8,043	10,093	5,235	5,136	58,642	81,104
1998	480,696	270,559	373,005	8,075	10,104	5,246	5,152	58,902	81,102
1999	481,451	273,086	373,659	8,106	10,115	5,256	5,167	59,163	81,099
2000	482,210	275,636	374,316	8,138	10,126	5,267	5,183	59,425	81,097

See explanatory information and SOURCE at end of table.

Appendix table 13. Total population in European countries and the United States: 1975-2000 (projected)

Year	Greece	Ireland	Italy	Nether-lands	Portugal	Spain	Sweden	U.K.
	In thousands							
1975	9,046	3,206	55,442	13,666	9,633	35,515	8,193	56,215
1976	9,167	3,288	55,701	13,774	9,699	35,937	8,216	56,206
1977	9,309	3,272	55,730	13,856	9,773	36,367	8,240	56,179
1978	9,430	3,314	56,127	13,942	9,830	36,778	8,263	56,167
1979	9,548	3,368	56,292	14,038	9,883	37,108	8,287	56,227
1980	9,642	3,401	56,416	14,150	9,819	37,366	8,311	56,314
1981	9,730	3,443	56,503	14,247	9,892	37,751	8,318	56,379
1982	9,790	3,480	56,639	14,313	9,969	37,961	8,326	56,335
1983	9,847	3,505	56,825	14,367	10,050	38,180	8,334	56,377
1984	9,900	3,529	56,983	14,424	10,129	38,342	8,342	56,488
1985	9,934	3,540	57,128	14,491	10,185	38,505	8,350	56,618
1986	9,964	3,541	57,221	14,572	10,230	38,668	8,348	56,763
1987	9,994	3,543	57,331	14,665	10,270	38,832	8,346	56,930
1988	10,017	3,578	57,370	14,717	10,290	38,996	8,344	56,992
1989	10,039	3,614	57,409	14,770	10,310	39,164	8,341	57,054
1990	10,047	3,720	57,322	14,752	10,285	39,333	8,339	56,926
1991	10,127	3,695	57,430	14,888	10,200	39,295	8,426	57,196
1992	10,208	3,670	57,539	15,026	10,117	39,257	8,515	57,467
1993	10,290	3,646	57,648	15,165	10,033	39,219	8,604	57,739
1994	10,372	3,621	57,758	15,305	9,951	39,182	8,694	58,013
1995	10,455	3,597	57,867	15,446	9,869	39,144	8,785	58,288
1996	10,502	3,622	57,880	15,515	9,870	39,163	8,817	58,406
1997	10,549	3,647	57,892	15,584	9,871	39,181	8,849	58,525
1998	10,597	3,672	57,905	15,654	9,873	39,200	8,882	58,644
1999	10,644	3,697	57,917	15,724	9,874	39,218	8,914	58,763
2000	10,692	3,723	57,930	15,794	9,875	39,237	8,947	58,882

See explanatory information and SOURCE at end of table.

Appendix table 13. Total population in European countries and the United States: 1975-2000 (projected)

Year	Total EFTA	Iceland	Norway	Switzer-land	Central Europe	Bulgaria	Czecho-slovakia	Czech Rep	Slovak Rep
					In thousands				
1975	10,631	218	4,007	6,406	89,333	8,722	14,802	—	—
1976	10,632	220	4,022	6,390	89,988	8,750	14,903	—	—
1977	10,634	222	4,038	6,374	90,647	8,777	15,004	—	—
1978	10,636	224	4,053	6,358	91,312	8,805	15,106	—	—
1979	10,637	226	4,069	6,342	91,982	8,833	15,208	—	—
1980	10,639	228	4,085	6,327	92,658	8,861	15,312	—	—
1981	10,684	231	4,098	6,355	93,127	8,881	15,349	—	—
1982	10,729	233	4,112	6,384	93,599	8,901	15,387	—	—
1983	10,774	236	4,125	6,413	94,075	8,921	15,425	—	—
1984	10,819	239	4,139	6,441	94,554	8,940	15,462	—	—
1985	10,864	241	4,153	6,470	95,037	8,960	15,500	—	—
1986	10,888	244	4,164	6,480	95,410	8,970	15,533	—	—
1987	10,913	246	4,176	6,490	95,786	8,980	15,567	—	—
1988	10,937	249	4,188	6,500	96,163	8,990	15,600	—	—
1989	10,961	251	4,200	6,511	96,543	9,000	15,634	—	—
1990	10,986	253	4,212	6,521	96,925	9,010	15,667	—	—
1991	11,123	257	4,240	6,627	96,618	8,887	—	10,312	5,321
1992	11,263	260	4,268	6,735	96,385	8,766	—	10,328	5,344
1993	11,405	263	4,296	6,845	96,155	8,646	—	10,343	5,367
1994	11,548	267	4,324	6,957	95,927	8,528	—	10,359	5,391
1995	11,694	270	4,353	7,071	95,702	8,411	—	10,374	5,414
1996	11,753	273	4,371	7,110	95,740	8,375	—	10,400	5,441
1997	11,813	275	4,389	7,149	95,779	8,339	—	10,427	5,468
1998	11,873	278	4,407	7,189	95,818	8,303	—	10,454	5,496
1999	11,933	280	4,425	7,228	95,859	8,267	—	10,480	5,523
2000	11,994	283	4,443	7,268	95,900	8,231	—	10,507	5,551

See explanatory information and SOURCE at end of table.

Appendix table 13. Total population in European countries and the United States: 1975-2000 (projected)

Year	Hungary	Poland	Romania
	In thousands		
1975	10,541	34,023	21,245
1976	10,575	34,327	21,433
1977	10,609	34,635	21,622
1978	10,643	34,945	21,814
1979	10,677	35,257	22,007
1980	10,711	35,573	22,201
1981	10,699	35,893	22,305
1982	10,686	36,216	22,409
1983	10,674	36,542	22,514
1984	10,661	36,871	22,619
1985	10,649	37,203	22,725
1986	10,629	37,444	22,833
1987	10,610	37,686	22,942
1988	10,591	37,930	23,051
1989	10,572	38,176	23,161
1990	10,553	38,423	23,272
1991	10,483	38,437	23,178
1992	10,413	38,451	23,084
1993	10,343	38,464	22,991
1994	10,274	38,478	22,898
1995	10,206	38,492	22,805
1996	10,155	38,582	22,787
1997	10,104	38,673	22,769
1998	10,053	38,763	22,750
1999	10,002	38,854	22,732
2000	9,952	38,945	22,714

EU = European Union; EFTA = European Free Trade Association; — = Czechoslovakia became the Czech Republic and the Slovak Republic in 1991. As a result, data for the Czech Republic and Slovak Republic are unavailable prior to 1990. Similarly, Czechoslavakia did not exist after 1990 and therefore, data are unavailable.

SOURCE: E. Bos, A. Levin, and M. T. Vu, *World Bank Population Projections,* (Washington, DC: World Bank, 1993).

Appendix table 14. Gross domestic product in European countries and the United States: 1975-93

Year	Total Europe	United States	Total EU	Austria	Belgium	Denmark	Finland	France	Germany	Greece
	Millions of constant 1987 PPP dollars[1]									
1975	3,449,274	3,221,834	3,075,023	76,996	104,730	54,701	46,157	595,068	705,366	46,235
1976	3,601,844	3,380,639	3,220,184	80,486	110,758	58,152	46,183	620,246	743,914	49,166
1977	3,697,816	3,533,417	3,309,473	84,037	111,321	59,158	46,221	640,253	764,845	50,853
1978	3,814,598	3,703,251	3,419,517	84,474	114,590	59,964	47,223	661,665	787,274	54,263
1979	3,942,381	3,796,537	3,541,354	88,442	116,968	62,106	50,819	683,120	820,402	56,280
1980	3,997,826	3,776,377	3,589,581	91,053	121,801	61,803	53,628	694,243	830,732	57,254
1981	4,017,859	3,843,013	3,605,721	91,240	117,664	61,041	54,284	705,321	832,071	57,328
1982	4,049,735	3,760,255	3,634,596	92,219	119,466	62,845	56,268	721,564	824,610	57,550
1983	4,115,816	3,906,666	3,692,302	94,029	120,042	64,456	57,922	726,690	837,443	57,729
1984	4,214,223	4,148,490	3,777,282	95,306	122,592	67,304	59,698	737,573	859,925	59,347
1985	4,322,053	4,279,676	3,872,025	97,635	123,642	70,157	61,676	751,053	876,625	61,209
1986	4,430,982	4,404,292	3,975,190	98,752	125,398	72,679	62,998	769,271	896,149	62,211
1987	4,558,142	4,539,930	4,092,468	100,433	127,886	72,907	64,721	785,957	908,895	61,769
1988	4,737,986	4,718,710	4,259,942	104,545	134,229	73,763	67,972	818,974	942,744	64,281
1989	4,896,724	4,843,018	4,402,511	108,450	138,886	74,165	71,263	849,899	974,986	66,522
1990	5,036,909	4,878,269	4,531,115	113,427	143,954	75,695	71,486	869,175	1,027,391	66,491
1991	5,172,864	4,819,610	4,670,607	117,275	146,590	76,653	66,490	879,377	1,145,251	67,393
1992	5,216,916	4,915,715	4,718,492	118,960	148,148	77,585	63,870	887,532	1,168,544	67,489
1993	5,180,568	5,051,858	4,688,065	117,914	147,243	77,997	62,084	878,816	1,141,188	67,517

Year	Ireland	Italy	Netherlands	Portugal	Spain	Sweden	U.K.	Total EFTA	Norway	Switzerland
	Millions of constant 1987 PPP dollars[1]									
1975	18,495	515,833	150,085	42,914	273,026	98,782	568,573	374,250	55,544	94,364
1976	18,778	549,805	157,846	46,038	281,249	99,692	584,232	381,660	59,274	93,499
1977	20,292	565,000	161,417	48,470	290,524	98,083	597,341	388,343	61,482	95,761
1978	21,731	589,284	165,333	49,950	295,744	99,988	619,720	395,081	64,217	96,231
1979	22,426	624,565	169,295	53,029	296,310	103,773	636,852	401,027	56,251	98,651
1980	23,096	651,027	170,832	55,402	300,872	105,441	622,519	408,245	52,208	102,940
1981	23,868	659,756	173,687	56,537	301,474	105,449	616,972	412,138	53,639	104,484
1982	24,425	661,236	171,214	57,703	306,172	106,680	627,812	415,139	53,414	103,459
1983	24,350	667,534	173,560	57,617	312,786	108,665	650,094	423,514	55,331	104,544
1984	25,412	686,310	179,163	56,577	317,271	112,907	665,808	436,941	59,465	106,415
1985	26,204	704,895	183,821	58,132	325,715	115,438	690,572	450,028	61,656	110,349
1986	26,104	720,459	187,467	60,515	336,035	118,050	718,902	455,793	59,014	113,491
1987	27,404	746,499	189,090	63,705	354,979	121,857	753,377	465,674	59,103	115,766
1988	28,758	776,821	193,985	66,237	373,450	124,560	786,700	478,044	57,981	119,206
1989	30,612	799,293	203,138	69,641	391,128	127,698	804,242	494,213	59,283	123,733
1990	33,134	817,492	211,044	72,678	405,701	129,051	808,358	505,794	61,358	126,666
1991	33,972	828,712	215,140	74,233	415,192	126,875	788,094	502,258	61,874	125,900
1992	34,869	835,792	218,954	75,604	420,104	124,258	783,871	498,424	61,513	126,120
1993	35,656	838,278	218,317	74,083	412,926	120,791	796,045	492,503	62,498	125,485

EU = European Union; EFTA = European Free Trade Association

[1] Conversion of foreign currencies to U.S. dollars are calculated with the Organisation for Economic Co-operation and Development purchasing power parity (PPP) exchange rates. Constant 1987 dollars are based on the U.S. Department of Commerce calendar year gross domestic product implicit price deflators.

SOURCES: National Science Foundation, Science Resources Studies Division, *National Patterns of R&D Resources: 1994*, NSF 95-304 (Arlington, VA: NSF, 1995); and Organisation for Economic Co-operation and Development. *Main Science and Technology Indicators* database.

Appendix table 15. U.S. patents granted to inventors from selected European countries: 1980-93

Year	Total Europe	United States	Total EU	Austria	Belgium	Denmark	Finland	France	Germany
1980	10,002	37,356	8,658	267	244	157	121	2,087	5,782
1981	10,629	39,223	9,297	279	263	130	140	2,181	6,304
1982	9,353	33,896	8,141	229	224	121	125	1,975	5,467
1983	9,168	32,871	8,085	267	205	125	116	1,895	5,477
1984	10,559	38,367	9,298	256	240	150	167	2,162	6,323
1985	11,386	39,555	10,063	318	240	187	200	2,400	6,718
1986	11,510	38,126	10,217	357	243	182	210	2,369	6,856
1987	13,386	43,518	11,878	345	295	204	275	2,874	7,885
1988	12,402	40,496	11,036	337	302	151	232	2,661	7,353
1989	14,191	50,185	12,702	399	359	221	230	3,140	8,353
1990	13,040	47,393	11,644	393	313	158	304	2,866	7,610
1991	13,380	51,183	11,934	359	324	210	331	3,030	7,680
1992	12,891	52,253	11,587	370	324	193	360	3,029	7,311
1993	12,194	53,236	10,951	313	350	197	293	2,908	6,890

Year	Ireland	Italy	Nether-lands	Spain	Sweden	U.K.	Total EFTA	Norway	Switzer-land
1980	17	806	654	65	822	2,405	1,344	79	1,265
1981	17	883	641	58	766	2,473	1,332	93	1,239
1982	24	752	619	49	685	2,132	1,212	65	1,147
1983	18	625	626	50	623	1,930	1,083	66	1,017
1984	29	794	726	69	701	2,269	1,261	87	1,174
1985	30	919	766	78	857	2,494	1,323	90	1,233
1986	28	995	722	97	883	2,405	1,293	81	1,212
1987	38	1,183	922	115	948	2,775	1,508	135	1,373
1988	43	1,076	806	126	777	2,579	1,366	121	1,245
1989	65	1,297	1,060	131	837	3,094	1,489	126	1,363
1990	54	1,260	958	130	768	2,788	1,396	112	1,284
1991	55	1,209	992	153	716	2,799	1,446	111	1,335
1992	55	1,271	854	133	627	2,424	1,304	108	1,196
1993	53	1,286	801	159	635	2,294	1,243	117	1,126

EU = European Union; EFTA = European Free Trade Association

SOURCE: U.S. Patent and Trademark Office, Department of Commerce, unpublished tabulations, 1993.

Appendix table 16. First university degrees in science and engineering in selected European countries, by field: 1975-92

Year	Total Western Europe	United States	Total EU	Austria	Belgium	Denmark	Finland	France	Germany	Greece
					Natural sciences[1]					
1975	36,521	77,085	36,521	58	NA	NA	1,592	6,746	7,899	NA
1976	42,315	80,571	41,548	64	NA	NA	1,215	6,821	8,265	889
1977	43,228	80,891	42,620	64	NA	254	1,042	7,064	8,391	734
1978	43,746	79,286	43,222	297	NA	369	965	7,316	8,306	1,156
1979	42,790	76,817	42,134	296	NA	317	950	7,576	8,084	1,124
1980	43,520	74,157	42,864	311	NA	341	968	7,846	8,114	1,326
1981	45,236	72,095	44,580	314	NA	359	996	8,126	8,748	1,214
1982	46,243	70,178	45,587	372	NA	329	1,017	8,415	9,981	1,271
1983	49,196	67,564	48,540	387	NA	349	917	8,715	10,018	1,320
1984	49,828	66,069	49,172	431	NA	344	825	9,406	10,048	1,471
1985	52,062	65,780	51,047	386	930	491	850	10,009	10,312	1,346
1986	52,994	63,587	52,027	429	962	520	968	11,391	10,327	1,248
1987	55,675	61,288	54,494	441	933	515	642	12,068	10,611	1,457
1988	58,020	57,766	56,906	527	862	529	775	12,391	11,571	1,429
1989	59,524	56,382	58,314	545	797	598	539	13,270	12,473	1,402
1990	65,456	54,241	64,118	618	804	545	517	14,320	15,762	1,766
1991	66,656	56,757	65,323	668	811	768	515	15,900	15,568	1,391
1992	76,813	60,911	75,476	668	811	768	515	17,896	17,160	1,391
					Mathematics and computer science					
1975	11,122	23,385	11,117	124	NA	NA	NA	NA	5,334	NA
1976	14,262	21,749	14,262	111	NA	NA	764	NA	5,641	907
1977	14,039	20,729	13,892	118	NA	NA	711	NA	5,486	617
1978	14,268	19,925	14,110	330	NA	NA	667	NA	5,049	818
1979	14,391	20,670	14,235	342	NA	NA	586	NA	4,697	1,185
1980	14,283	22,686	14,128	359	NA	NA	571	NA	4,528	1,243
1981	14,481	26,406	14,327	304	NA	NA	522	NA	4,361	1,135
1982	14,145	32,139	13,991	337	NA	NA	480	NA	4,356	1,248
1983	14,465	37,239	14,312	325	NA	NA	420	NA	4,306	1,347
1984	14,856	45,777	14,704	356	NA	NA	474	NA	4,173	1,089
1985	16,029	54,388	15,676	341	332	NA	692	NA	4,272	1,159
1986	16,815	58,583	16,360	370	368	NA	698	NA	4,590	979
1987	17,605	56,553	17,131	532	282	NA	582	NA	4,729	1,004
1988	19,362	51,018	18,895	520	586	NA	732	NA	4,847	933
1989	20,000	46,402	19,547	537	495	NA	492	NA	5,306	867
1990	22,108	42,369	21,679	499	395	NA	733	NA	5,725	781
1991	24,582	40,194	24,133	503	316	NA	820	NA	6,828	1,062
1992	29,375	39,705	28,947	503	316	NA	820	NA	6,970	1,062

See explanatory information and SOURCES at end of table.

Appendix table 16. First university degrees in science and engineering in selected European countries, by field: 1975-92

Year	Ireland	Italy	Netherlands	Portugal	Spain	Sweden	U.K.[2]	Total EFTA	Norway	Switzerland
					Natural sciences[1]					
1975	470	7,000	1,161	NA	NA	695	10,900	0	NA	NA
1976	521	6,370	1,279	NA	4,302	686	11,136	767	NA	767
1977	507	6,303	1,311	NA	5,081	622	11,247	608	NA	608
1978	587	6,087	1,310	NA	4,647	564	11,618	524	NA	524
1979	612	5,428	1,020	NA	4,298	545	11,884	656	NA	656
1980	616	5,486	937	NA	4,414	417	12,088	656	NA	656
1981	628	5,544	1,104	NA	4,817	320	12,410	656	NA	656
1982	628	5,765	1,225	NA	3,444	245	12,895	656	NA	656
1983	960	5,994	1,360	NA	4,853	340	13,327	656	NA	656
1984	1,007	5,871	1,375	NA	5,051	420	12,923	656	NA	656
1985	1,050	5,573	1,391	708	5,051	448	12,502	1,015	290	725
1986	1,081	5,632	1,401	601	5,555	495	11,417	967	277	690
1987	1,251	5,685	1,573	336	6,192	581	12,209	1,181	350	831
1988	1,328	5,817	2,471	534	6,041	582	12,048	1,114	264	850
1989	1,231	6,408	1,814	647	6,501	584	11,505	1,210	294	916
1990	1,337	6,397	1,412	785	6,929	641	12,285	1,338	380	958
1991	1,171	6,438	1,338	785	6,869	667	12,434	1,333	376	957
1992	1,171	7,037	1,338	785	6,869	667	18,400	1,337	376	961
					Mathematics and computer science					
1975	NA	2,610	111	NA	NA	NA	2,938	5	5	NA
1976	10	3,543	129	NA	269	NA	2,888	0	NA	NA
1977	14	3,550	145	NA	385	NA	2,866	147	NA	147
1978	32	3,295	165	NA	856	2	2,896	158	NA	158
1979	83	2,958	150	NA	1,142	32	3,060	156	NA	156
1980	83	3,025	163	NA	981	52	3,123	155	NA	155
1981	167	3,093	179	NA	1,025	86	3,455	154	NA	154
1982	167	2,625	174	NA	693	141	3,770	154	NA	154
1983	156	2,228	174	NA	1,022	198	4,136	153	NA	153
1984	146	2,264	229	NA	1,232	247	4,494	152	NA	152
1985	327	2,163	199	142	1,232	274	4,543	353	207	146
1986	260	2,339	229	173	1,503	385	4,466	455	237	218
1987	297	2,584	300	249	1,450	581	4,541	474	227	247
1988	259	3,024	425	99	2,245	716	4,509	467	202	265
1989	428	3,239	403	99	2,395	758	4,528	453	142	311
1990	596	3,239	325	819	3,224	736	4,607	429	110	319
1991	414	3,261	340	819	3,760	787	5,223	449	118	331
1992	414	3,356	340	819	3,760	787	9,800	428	118	310

See explanatory information and SOURCES at end of table.

Appendix table 16. First university degrees in science and engineering in selected European countries, by field: 1975-92

Year	Total Western Europe	United States	Total EU	Austria	Belgium	Denmark	Finland	France	Germany	Greece
					Agriculture					
1975	5,265	16,531	5,265	87	NA	NA	195	NA	2,282	NA
1976	6,553	18,289	6,553	95	562	155	241	NA	2,161	NA
1977	7,240	20,199	7,240	110	568	142	256	NA	2,324	181
1978	8,205	21,027	8,205	135	329	169	269	NA	2,668	221
1979	8,773	21,631	8,773	123	432	177	260	NA	3,045	427
1980	9,946	21,121	9,946	191	567	190	240	NA	3,480	392
1981	10,873	20,166	10,873	196	582	225	259	NA	3,763	460
1982	11,514	19,235	11,514	239	597	281	237	NA	4,148	470
1983	12,112	19,170	12,112	220	360	248	253	NA	4,374	435
1984	12,452	17,303	12,452	284	465	248	231	NA	4,468	402
1985	13,346	15,879	13,084	305	600	248	276	NA	4,390	445
1986	13,909	14,740	13,631	296	552	281	332	NA	4,792	352
1987	14,112	15,082	13,876	296	446	252	339	NA	4,644	481
1988	16,175	14,331	15,916	271	361	272	521	NA	4,578	486
1989	15,707	13,559	15,466	391	245	293	286	NA	4,894	491
1990	17,242	8,411	17,029	393	221	270	532	NA	6,248	540
1991	16,722	8,643	16,450	381	200	270	483	NA	5,979	506
1992	16,795	10,492	16,577	381	200	270	483	NA	5,770	506
					Social and behavioral science					
1975	50,029	163,147	50,029	99	NA	NA	1,922	700	25,182	NA
1976	57,701	157,405	57,701	173	1,217	NA	1,539	845	26,242	2,465
1977	64,211	148,533	64,211	130	1,163	465	1,436	1,063	28,176	1,950
1978	65,069	144,018	65,069	183	1,302	540	1,245	1,337	26,741	2,546
1979	65,942	138,903	65,942	263	1,306	549	1,061	1,681	25,633	3,138
1980	64,825	135,632	64,825	263	1,310	608	1,034	2,115	24,652	2,485
1981	62,361	132,607	62,361	244	1,326	583	911	2,660	24,155	1,745
1982	65,519	133,565	65,519	471	1,343	683	782	3,346	26,443	1,637
1983	68,330	128,651	68,330	482	1,506	612	742	4,208	28,439	1,583
1984	72,641	126,078	72,641	435	1,688	573	736	4,295	29,361	2,086
1985	79,155	125,033	78,167	482	3,463	594	693	4,688	30,156	1,694
1986	84,702	127,558	83,674	520	4,074	608	783	5,067	31,239	1,686
1987	86,077	131,935	85,112	533	4,067	659	733	5,482	31,524	2,397
1988	87,613	136,717	86,641	513	4,060	666	756	5,891	32,483	2,124
1989	92,090	146,737	90,910	623	5,409	674	853	6,787	33,355	1,882
1990	96,227	159,368	94,899	683	5,409	670	967	6,991	37,878	1,782
1991	97,392	170,105	96,027	758	5,409	670	744	7,344	36,792	1,967
1992	112,930	182,166	111,406	758	5,409	670	744	8,509	37,126	1,967

See explanatory information and SOURCES at end of table.

Appendix table 16. First university degrees in science and engineering in selected European countries, by field: 1975-92

Year	Ireland	Italy	Netherlands	Portugal	Spain	Sweden	U.K.[2]	Total EFTA	Norway	Switzerland
Agriculture										
1975	170	1,305	152	NA	NA	211	863	NA	NA	NA
1976	158	1,380	209	NA	430	212	950	NA	NA	181
1977	194	1,519	184	NA	485	188	1,089	NA	NA	185
1978	188	1,738	499	NA	638	167	1,184	NA	NA	196
1979	173	1,881	435	NA	459	141	1,220	NA	NA	179
1980	190	2,225	447	NA	452	158	1,415	NA	NA	187
1981	188	2,631	501	NA	497	176	1,395	NA	NA	196
1982	188	2,734	550	NA	456	197	1,417	NA	NA	205
1983	213	2,840	774	NA	710	202	1,483	NA	NA	215
1984	177	2,897	784	NA	859	190	1,447	NA	NA	225
1985	214	2,956	695	327	975	206	1,447	262	17	245
1986	214	3,016	836	294	1,107	217	1,342	278	13	265
1987	207	2,948	1,233	NA	1,417	242	1,370	236	3	233
1988	244	2,882	1,776	NA	2,938	229	1,358	259	3	256
1989	109	2,642	937	421	3,199	215	1,343	241	5	236
1990	129	2,624	1,097	300	3,149	224	1,301	213	25	188
1991	129	2,607	1,097	300	3,149	137	1,212	272	25	247
1992	129	2,755	1,097	300	3,149	137	1,400	218	25	193
Social and behavioral science										
1975	191	5,206	2,365	NA	NA	4,752	9,612	NA	NA	NA
1976	256	5,398	2,391	NA	5,301	3,233	8,641	NA	NA	NA
1977	268	5,397	2,412	NA	6,815	2,210	12,726	NA	NA	NA
1978	241	5,785	2,461	NA	9,771	1,511	11,406	NA	NA	NA
1979	406	5,569	2,383	NA	10,828	1,468	11,657	NA	NA	NA
1980	448	5,194	2,410	NA	11,294	1,084	11,928	NA	NA	NA
1981	446	4,845	2,609	NA	11,708	800	10,328	NA	NA	NA
1982	446	6,623	2,937	NA	9,710	591	10,507	NA	NA	NA
1983	389	9,054	2,723	NA	7,299	633	10,660	NA	NA	NA
1984	485	9,691	3,098	NA	7,553	728	11,912	NA	NA	NA
1985	576	10,374	3,407	874	8,088	651	12,427	988	382	606
1986	576	11,104	4,649	1,006	9,790	536	12,036	1,028	350	678
1987	170	12,955	6,345	1,045	6,277	444	12,481	965	354	611
1988	626	15,115	5,830	1,086	4,024	480	12,986	972	321	651
1989	470	16,024	4,215	1,129	5,003	429	14,057	1,180	496	684
1990	491	16,460	4,973	1,129	5,519	367	11,580	1,328	620	708
1991	491	16,908	4,973	1,129	5,519	1,200	12,123	1,365	600	765
1992	491	19,311	4,973	1,129	5,519	1,200	23,600	1,524	600	924

See explanatory information and SOURCES at end of table.

Appendix table 16. First university degrees in science and engineering in selected European countries, by field: 1975-92

Year	Total Western Europe	United States	Total EU	Austria	Belgium	Denmark	Finland	France	Germany	Greece
					Engineering					
1975	49,916	39,824	49,916	457	NA	NA	869	9,956	18,528	957
1976	50,053	38,790	50,053	513	1,030	NA	1,092	10,264	17,434	1,012
1977	57,176	41,357	57,176	502	1,422	1,154	872	10,176	19,658	1,079
1978	58,004	47,251	58,004	490	1,781	1,073	834	10,429	19,879	1,222
1979	57,439	53,469	57,439	549	1,459	1,056	967	11,100	19,492	1,247
1980	58,968	58,810	58,968	730	1,196	1,187	1,023	11,548	20,111	1,211
1981	63,526	63,717	63,526	647	1,253	1,220	1,059	11,754	20,003	1,335
1982	64,513	67,460	64,513	679	1,312	1,198	1,083	12,156	19,862	1,561
1983	66,129	72,670	66,129	679	1,426	1,312	1,082	12,650	20,024	1,620
1984	68,038	76,153	68,038	676	1,550	1,728	1,029	12,670	21,050	1,269
1985	72,620	77,572	71,854	630	1,684	1,264	2,797	13,659	22,412	1,546
1986	76,974	76,820	76,094	694	3,254	1,652	2,698	13,107	24,218	1,569
1987	82,784	74,425	80,892	801	3,545	1,738	2,723	13,848	26,725	1,385
1988	87,723	70,154	85,677	784	4,069	1,994	2,795	14,276	27,278	1,421
1989	92,498	66,947	89,747	922	4,671	2,229	2,595	14,899	29,933	1,457
1990	102,971	64,705	100,391	989	4,832	2,657	2,921	16,080	38,564	2,116
1991	105,867	62,187	103,102	1,048	4,999	2,679	2,939	16,589	39,173	1,997
1992	116,605	61,941	113,748	1,048	4,999	2,679	2,939	17,847	38,852	1,997

See explanatory information and SOURCES at end of table.

Appendix table 16. First university degrees in science and engineering in selected European countries, by field: 1975-92

Year	Ireland	Italy	Netherlands	Portugal	Spain	Sweden	U.K.[2]	Total EFTA	Norway	Switzerland
					Engineering					
1975	368	6,949	2,162	NA	NA	1,724	7,946	NA	NA	NA
1976	343	7,107	1,888	NA	NA	1,796	7,574	NA	NA	427
1977	361	6,923	2,002	NA	3,220	1,745	8,062	NA	NA	526
1978	515	6,837	1,339	NA	3,304	1,695	8,606	NA	NA	516
1979	434	6,733	1,403	NA	2,179	1,713	9,107	NA	NA	542
1980	557	6,670	1,479	NA	1,911	1,766	9,579	NA	NA	544
1981	556	6,607	1,555	NA	5,671	1,821	10,045	NA	NA	546
1982	556	6,350	1,585	NA	6,160	1,878	10,133	NA	NA	548
1983	951	6,103	1,727	NA	6,075	1,891	10,589	NA	NA	550
1984	943	6,035	1,985	NA	6,486	2,113	10,505	NA	NA	552
1985	985	5,686	1,985	1,135	6,486	1,952	9,633	766	210	556
1986	1,200	5,901	2,123	1,163	6,569	2,083	9,863	880	263	617
1987	1,093	5,770	2,835	1,737	6,959	2,460	9,273	1,892	1,281	611
1988	1,181	6,107	4,493	1,810	7,497	2,344	9,628	2,046	1,332	714
1989	1,235	6,944	2,998	2,064	7,566	2,414	9,820	2,751	2,084	667
1990	1,302	6,944	2,456	1,222	8,190	2,377	9,741	2,580	1,891	689
1991	1,096	7,252	2,759	1,222	9,193	2,417	9,739	2,765	2,080	685
1992	1,096	7,900	2,759	1,222	9,193	2,417	18,800	2,857	2,080	777

EU = European Union; EFTA = European Free Trade Association; NA = not available

NOTES: Data are compiled from numerous national and international sources, and degree fields may not be strictly comparable. Detailed national education data were available for Austria, France, Germany, Switzerland, the United Kingdom and the United States. These data were reconfigured to the International Standard Classification of Instructional Programs. First university degrees in different countries are of different duration and may not be academically equivalent. Data for Germany include East and West German data for 1990-92; prior years (1975-89) include only West German data. Data for the United Kingdom and the Netherlands do not include open universities. See Notes on Data Series for degrees included in first university degrees.

[1] Natural sciences in this table include physical, biological, and environmental sciences.

[2] U.K. 1992 data contain polytechnics brought into the university system.

SOURCES: Organisation for Economic Co-operation and Development (OECD), Center for Research and Innovation (CERI) "Education at a Glance" database, 1994; United Nations Educational, Scientific, and Cultural Organization, *Statistical Yearbook,* annual series, supplemented by national sources: Austria—Population Division, Austrian Central Statistical Office, unpublished tabulations; France—Ministère de l'Education Nationale, *Repères et Références: Statistiques sur* les Enseignements; Germany—Statistisches Bundesamt Wiesbaden, *Prüfungen an Hochschulen;* Switzerland—Federal Office of Statistics, Education and Society Division, Universities and Science Section, unpublished tabulations; United Kingdom—University Grants Committee, *University Statistics,* Universities Statistical Record, and the Department of Education and Science, unpublished tabulations; United States—National Science Foundation, Science Resources Studies Division, *Science and Engineering Degrees: 1966-93,* NSF 95-312 (Arlington, VA: NSF, 1995). For additional national sources, see Contacts and References.

Appendix table 17. First university degrees in science and engineering earned by women in selected European countries and the United States, by field: 1981-92

Year	Total Western Europe	United States	Total EU	Austria	Belgium	Denmark	Finland	France	Germany	Greece
					Natural sciences[1]					
1981	14,405	27,002	14,405	128	NA	44	474	NA	3,071	359
1982	15,081	27,004	15,081	126	NA	48	488	NA	3,832	361
1983	16,615	26,566	16,615	144	NA	56	464	NA	3,886	389
1984	16,136	26,248	15,996	157	NA	50	437	NA	3,812	519
1985	17,057	26,709	16,788	151	404	51	458	NA	3,729	526
1986	17,242	26,073	16,988	143	414	64	480	NA	4,056	525
1987	22,078	25,651	21,751	177	450	62	321	4,174	4,028	557
1988	23,066	25,471	22,737	166	426	93	400	4,339	4,452	570
1989	23,702	24,773	23,368	222	404	90	270	4,689	4,480	584
1990	26,650	24,503	26,268	227	404	110	258	4,878	6,087	656
1991	28,253	26,383	27,873	236	404	231	267	5,484	6,728	738
1992	NA	NA	NA	NA	NA	NA	NA	6,414	6,932	NA
					Mathematics and computer science					
1981	5,143	9,734	5,143	91	NA	25	229	NA	1,462	286
1982	5,087	12,173	5,087	106	NA	29	199	NA	1,585	344
1983	5,291	14,490	5,291	106	NA	28	158	NA	1,457	411
1984	5,445	17,980	5,422	119	NA	25	176	NA	1,391	381
1985	5,727	21,467	5,658	100	147	28	147	NA	1,354	405
1986	5,919	22,742	5,838	92	119	29	159	NA	1,314	396
1987	6,224	21,615	6,146	147	159	29	112	NA	1,284	389
1988	6,325	18,813	6,227	117	157	37	142	NA	1,254	370
1989	6,547	16,651	6,463	151	156	47	89	NA	1,179	351
1990	7,072	15,185	7,002	128	156	NA	115	NA	1,328	336
1991	7,726	14,494	7,633	120	156	NA	95	NA	1,626	322
1992	NA	NA	NA	NA	NA	NA	NA	NA	1,771	NA
					Agriculture					
1981	3,250	6,454	3,250	48	NA	79	107	NA	1,519	128
1982	3,614	6,261	3,614	67	NA	107	88	NA	1,845	158
1983	4,065	6,455	4,065	54	NA	71	99	NA	1,937	122
1984	4,329	5,703	4,277	63	NA	92	81	NA	1,930	145
1985	4,593	5,137	4,536	81	156	72	127	NA	1,856	143
1986	5,054	4,799	4,986	66	152	102	157	NA	2,135	115
1987	5,377	4,705	5,316	85	130	114	161	NA	2,059	184
1988	5,692	4,511	5,616	111	110	128	199	NA	2,062	183
1989	6,120	4,224	6,045	144	94	144	199	NA	2,152	182
1990	6,582	2,992	6,510	141	94	NA	199	NA	2,731	201
1991	6,340	2,600	6,260	125	94	NA	199	NA	2,623	222
1992	NA	NA	NA	NA	NA	NA	NA	NA	2,722	NA

See explanatory information and SOURCES at end of table.

Appendix table 17. First university degrees in science and engineering earned by women in selected European countries and the United States, by field: 1981-92

Year	Ireland	Italy	Netherlands	Portugal	Spain	Sweden	U.K.[2]	Total EFTA	Norway	Switzerland
					Natural sciences[1]					
1981	284	3,662	199	NA	2,202	NA	3,982	0	NA	NA
1982	253	3,696	249	NA	1,627	NA	4,401	0	NA	NA
1983	510	3,642	271	239	2,283	NA	4,731	0	NA	NA
1984	520	3,171	285	117	2,407	NA	4,521	140	NA	140
1985	493	3,171	285	410	2,407	173	4,530	269	103	166
1986	509	3,251	262	354	2,391	233	4,306	254	92	162
1987	525	3,291	328	176	2,969	243	4,450	327	144	183
1988	541	3,294	567	331	2,883	264	4,410	329	115	214
1989	557	3,688	433	207	3,185	275	4,284	334	114	220
1990	574	3,687	393	541	3,442	298	4,713	382	143	239
1991	591	3,707	399	541	3,406	333	4,808	380	137	243
1992	NA	3,837	NA	NA	NA	NA	8,100	NA	NA	258
					Mathematics and computer science					
1981	49	1,601	NA	NA	426	NA	974	0	NA	NA
1982	17	1,396	NA	NA	258	NA	1,153	0	NA	NA
1983	0	1,340	NA	143	442	NA	1,206	0	NA	NA
1984	49	1,321	NA	80	516	NA	1,364	23	NA	23
1985	94	1,319	24	108	516	84	1,332	69	51	18
1986	90	1,543	32	107	579	114	1,264	81	54	27
1987	87	1,596	50	154	774	169	1,196	78	46	32
1988	95	1,648	68	69	875	216	1,180	98	57	41
1989	103	1,701	61	262	977	232	1,154	84	37	47
1990	112	1,729	59	357	1,303	217	1,161	70	36	34
1991	122	1,758	46	357	1,475	220	1,336	93	37	56
1992	NA	1,722	NA	NA	NA	NA	3,300	NA	NA	45
					Agriculture					
1981	40	571	136	NA	142	NA	480	0	NA	NA
1982	27	602	119	NA	121	NA	480	0	NA	NA
1983	43	683	201	77	213	NA	565	0	NA	NA
1984	36	774	223	130	271	NA	532	52	NA	52
1985	41	741	193	147	380	NA	599	57	1	56
1986	44	716	273	127	518	NA	581	68	2	66
1987	47	713	304	144	659	97	620	61	1	60
1988	47	726	338	163	838	99	611	76	1	75
1989	47	740	376	185	1,065	102	615	75	1	74
1990	47	732	300	185	1,167	116	597	72	1	71
1991	47	724	250	185	1,167	57	567	80	1	79
1992	NA	810	NA	NA	NA	NA	700	NA	NA	73

See explanatory information and SOURCES at end of table.

Appendix table 17. First university degrees in science and engineering earned by women in selected European countries and the United States, by field: 1981-92

Year	Total Western Europe	United States	Total EU	Austria	Belgium	Denmark	Finland	France	Germany	Greece
					Social science					
1981	25,225	68,386	25,225	92	NA	198	584	NA	9,916	795
1982	27,199	70,305	27,199	164	NA	254	536	NA	11,261	646
1983	27,257	68,259	27,257	221	NA	224	474	NA	12,237	622
1984	28,482	66,519	27,827	192	NA	226	462	NA	12,432	1,025
1985	31,870	66,263	31,386	265	1,287	224	446	NA	12,964	829
1986	34,706	67,715	34,206	263	1,505	242	513	NA	13,479	808
1987	38,301	70,435	37,812	288	1,782	256	488	2,012	13,634	1,263
1988	40,171	73,585	39,667	307	2,111	270	498	2,330	14,089	1,097
1989	41,874	79,849	41,313	328	2,500	285	498	2,589	13,847	953
1990	44,872	87,359	44,312	383	2,500	285	498	3,477	16,209	892
1991	45,515	95,205	44,933	457	2,500	285	498	3,419	15,777	835
1992	NA	NA	NA	NA	NA	NA	NA	4,173	16,297	NA
					Engineering					
1981	2,539	7,063	2,539	18	NA	64	154	NA	880	162
1982	2,844	8,275	2,844	21	NA	73	153	NA	878	211
1983	3,748	9,652	3,748	16	NA	71	159	NA	952	263
1984	3,823	10,729	3,808	31	NA	115	171	NA	1,018	224
1985	4,593	11,246	4,542	16	194	62	331	NA	1,191	298
1986	5,353	11,138	5,276	23	395	109	283	NA	1,507	282
1987	6,195	11,404	5,923	25	385	143	306	NA	1,761	297
1988	9,584	10,779	9,208	44	551	163	342	2,615	1,794	308
1989	10,605	10,188	10,105	52	788	322	329	2,811	1,844	320
1990	13,958	9,973	13,524	62	788	462	374	3,103	4,434	366
1991	14,928	9,665	14,430	70	788	521	390	3,195	4,634	418
1992	NA	NA	NA	NA	NA	NA	NA	3,505	4,218	NA

See explanatory information and SOURCES at end of table.

Appendix table 17. First university degrees in science and engineering earned by women in selected European countries and the United States, by field: 1981-92

Year	Ireland	Italy	Netherlands	Portugal	Spain	Sweden	U.K.[2]	Total EFTA	Norway	Switzerland
Social science										
1981	257	2,304	694	NA	5,788	NA	4,597	0	NA	NA
1982	250	3,455	746	NA	5,126	NA	4,761	0	NA	NA
1983	197	3,555	799	627	3,415	NA	4,886	0	NA	NA
1984	230	3,749	827	621	3,262	NA	4,801	655	181	474
1985	322	4,511	1,015	571	3,795	NA	5,157	484	159	325
1986	311	4,957	1,204	584	4,594	NA	5,746	500	162	338
1987	300	5,519	1,329	624	4,282	214	5,822	489	168	321
1988	300	6,294	1,466	667	3,990	239	6,009	504	168	336
1989	300	7,177	1,618	713	3,719	266	6,520	561	168	393
1990	300	7,374	1,600	713	4,024	237	5,820	560	168	392
1991	300	7,577	1,500	713	4,024	938	6,110	582	168	414
1992	NA	8,864	NA	NA	NA	NA	11,800	NA	NA	495
Engineering										
1981	22	214	65	NA	321	NA	639	0	NA	NA
1982	30	284	55	NA	442	NA	697	0	NA	NA
1983	110	283	66	259	476	NA	1,093	0	NA	NA
1984	106	287	80	328	594	NA	854	15	NA	15
1985	137	292	80	262	594	239	846	51	34	17
1986	149	309	145	249	671	353	801	77	52	25
1987	161	355	168	372	723	436	791	272	254	18
1988	156	342	313	422	846	434	878	376	341	35
1989	151	413	283	497	943	464	888	500	470	30
1990	146	484	256	362	1,135	484	1,069	434	402	32
1991	141	518	293	362	1,415	518	1,167	498	466	32
1992	NA	555	NA	NA	NA	NA	4,800	NA	NA	26

EU = European Union; EFTA = European Free Trade Association; NA = not available

NOTES: Data are compiled from numerous national and international sources, and degree fields may not be strictly comparable. Detailed national education data were available for Austria, France, Germany, Switzerland, the United Kingdom, and the United States. These data were reconfigured to the International Standard Classification of Instructional Programs. First university degrees in different countries are of different duration and may not be academically equivalent. Data for Germany include East and West German data for 1990-92; prior years (1975-89) include only West German data. Data for the United Kingdom and the Netherlands do not include open universities. See Notes on Data Series for degrees included in first university degrees.

[1] Natural sciences in this table include physical, biological, and environmental sciences.

[2] U.K. 1992 data contain polytechnics brought into the university system.

SOURCES: Organisation for Economic Co-operation and Development (OECD), Center for Research and Innovation (CERI) "Education at a Glance" database, 1994; United Nations Educational, Scientific, and Cultural Organization, *Statistical Yearbook,* annual series, supplemented by national sources: Austria—Population Division, Austrian Central Statistical Office, unpublished tabulations; France—Ministère de l'Education Nationale, *Repères et Références: Statistiques sur les Enseignements;* Germany—Statistisches Bundesamt Wiesbaden, *Prüfungen an Hochschulen;* Switzerland—Federal Office of Statistics, Education and Society Division, Universities and Science Section, unpublished tabulations; United Kingdom—University Grants Committee, *University Statistics,* Universities Statistical Record, and the Department of Education and Science, unpublished tabulations; United States—National Science Foundation, Science Resources Studies Division, *Science and Engineering Degrees: 1966-93,* NSF 95-312 (Arlington, VA: NSF, 1995). For additional national sources, see Contacts and References.

Appendix table 18. First university degrees in science and engineering earned by women in selected European countries and the United States: 1981-92

Year	Total Western Europe	United States	Total EU	Austria	Belgium	Denmark	Finland	France	Germany	Greece
					Natural sciences[1]					
1981	22,463	43,190	22,463	267	NA	148	810	NA	6,052	773
1982	23,414	45,438	23,414	299	NA	184	775	NA	7,262	863
1983	25,499	47,511	25,499	304	NA	155	721	NA	7,280	922
1984	25,402	49,931	25,187	339	NA	167	694	NA	7,133	1,045
1985	27,120	53,313	26,725	332	707	151	732	NA	6,939	1,074
1986	27,868	53,614	27,465	301	685	195	796	NA	7,505	1,036
1987	29,505	51,971	29,039	409	739	205	594	NA	7,371	1,130
1988	35,083	48,795	34,580	394	694	258	741	4,339	7,768	1,123
1989	36,369	45,648	35,876	517	654	281	558	4,689	7,811	1,117
1990	40,194	42,680	39,670	496	654	NA	572	4,878	10,146	1,194
1991	42,088	43,477	41,535	481	654	NA	561	5,484	10,977	1,282
1992	NA		NA	NA	NA	NA	NA	6,414	11,425	NA
					Engineering					
1981	2,539	7,063	2,539	18	NA	64	154	NA	880	162
1982	2,844	8,275	2,844	21	NA	73	153	NA	878	211
1983	3,748	9,652	3,748	16	NA	71	159	NA	952	263
1984	3,823	10,729	3,808	31	NA	115	171	NA	1,018	224
1985	4,593	11,246	4,542	16	194	62	331	NA	1,191	298
1986	5,353	11,138	5,276	23	395	109	283	NA	1,507	282
1987	6,195	11,404	5,923	25	385	143	306	NA	1,761	297
1988	9,584	10,779	9,208	44	551	163	342	2,615	1,794	308
1989	10,605	10,188	10,105	52	788	322	329	2,811	1,844	320
1990	13,958	9,973	13,524	62	788	462	374	3,103	4,434	366
1991	14,928	9,665	14,430	70	788	521	390	3,195	4,634	418
1992	NA		NA	NA	NA	NA	NA	3,505	4,218	NA
					Natural sciences and engineering					
1981	25,002	50,253	25,002	285	NA	212	964	NA	6,932	935
1982	26,258	53,713	26,258	320	NA	257	928	NA	8,140	1,074
1983	29,247	57,163	29,247	320	NA	226	880	NA	8,232	1,185
1984	29,225	60,660	28,995	370	NA	282	865	NA	8,151	1,269
1985	31,713	64,559	31,267	348	901	213	1,063	NA	8,130	1,372
1986	33,221	64,752	32,741	324	1,080	304	1,079	NA	9,012	1,318
1987	35,700	63,375	34,962	434	1,124	348	900	NA	9,132	1,427
1988	44,667	59,574	43,788	438	1,245	421	1,083	6,954	9,562	1,431
1989	46,974	55,836	45,981	569	1,442	603	887	7,500	9,655	1,437
1990	54,152	52,653	53,194	558	1,442	462	946	7,981	14,580	1,559
1991	57,016	53,142	55,965	551	1,442	521	951	8,679	15,611	1,700
1992	NA		NA	NA	NA	NA	NA	9,919	15,643	NA

See explanatory information and SOURCES at end of table.

Appendix table 18. First university degrees in science and engineering earned by women in selected European countries and the United States: 1981-92

Year	Ireland	Italy	Netherlands	Portugal	Spain	Sweden	U.K.[2]	Total EFTA	Norway	Switzerland
					Natural sciences[1]					
1981	373	5,834	NA	NA	2,770	NA	5,436	NA	NA	NA
1982	297	5,694	NA	NA	2,006	NA	6,034	NA	NA	NA
1983	553	5,665	NA	459	2,938	NA	6,502	NA	NA	NA
1984	605	5,266	NA	327	3,194	NA	6,417	215	NA	215
1985	628	5,231	502	665	3,303	NA	6,461	395	155	240
1986	643	5,510	567	588	3,488	NA	6,151	403	148	255
1987	659	5,600	682	474	4,402	509	6,266	466	191	275
1988	682	5,668	973	563	4,596	579	6,201	503	173	330
1989	707	6,129	870	654	5,227	609	6,053	493	152	341
1990	733	6,148	752	1,083	5,912	631	6,471	524	180	344
1991	760	6,189	695	1,083	6,048	610	6,711	553	175	378
1992	NA	6,369	NA	NA	NA	NA	12,100	NA	NA	376
					Engineering					
1981	22	214	65	NA	321	NA	639	NA	NA	NA
1982	30	284	55	NA	442	NA	697	NA	NA	NA
1983	110	283	66	259	476	NA	1,093	NA	NA	NA
1984	106	287	80	328	594	NA	854	15	NA	15
1985	137	292	80	262	594	239	846	51	34	17
1986	149	309	145	249	671	353	801	77	52	25
1987	161	355	168	372	723	436	791	272	254	18
1988	156	342	313	422	846	434	878	376	341	35
1989	151	413	283	497	943	464	888	500	470	30
1990	146	484	256	362	1,135	484	1,069	434	402	32
1991	141	518	293	362	1,415	518	1,167	498	466	32
1992	NA	555	NA	NA	NA	NA	4,800	NA	NA	26
					Natural sciences and engineering					
1981	395	6,048	65	NA	3,091	NA	6,075	NA	NA	NA
1982	327	5,978	55	NA	2,448	NA	6,731	NA	NA	NA
1983	663	5,948	66	718	3,414	NA	7,595	NA	NA	NA
1984	711	5,553	80	655	3,788	NA	7,271	230	NA	230
1985	765	5,523	582	927	3,897	239	7,307	446	189	257
1986	792	5,819	712	837	4,159	353	6,952	480	200	280
1987	820	5,955	850	846	5,125	945	7,057	738	445	293
1988	838	6,010	1,286	985	5,442	1,013	7,079	879	514	365
1989	858	6,542	1,153	1,151	6,170	1,073	6,941	993	622	371
1990	879	6,632	1,008	1,445	7,047	1,115	7,540	958	582	376
1991	901	6,707	988	1,445	7,463	1,128	7,878	1,051	641	410
1992	NA	6,924	NA	NA	NA	NA	16,900	NA	NA	402

See explanatory information and SOURCES at end of table.

Appendix table 18. First university degrees in science and engineering earned by women in selected European countries and the United States: 1981-92

Year	Total Western Europe	United States	Total EU	Austria	Belgium	Denmark	Finland	France	Germany	Greece
Science and engineering (including social science)										
1981	50,227	118,639	50,227	377	NA	410	1,548	NA	16,848	1,730
1982	53,457	124,018	53,457	484	NA	511	1,464	NA	19,401	1,720
1983	56,504	125,422	56,504	541	NA	450	1,354	NA	20,469	1,807
1984	57,707	127,179	56,822	562	NA	508	1,327	NA	20,583	2,294
1985	63,344	130,822	62,414	613	2,188	437	1,509	NA	21,094	2,201
1986	67,573	132,467	66,593	587	2,585	546	1,592	NA	22,491	2,126
1987	71,990	133,810	70,763	722	2,906	604	1,388	NA	22,766	2,690
1988	84,838	133,159	83,455	745	3,356	691	1,581	9,284	23,651	2,528
1989	88,848	135,685	87,294	897	3,942	888	1,385	10,089	23,502	2,390
1990	99,025	140,012	97,507	941	3,942	747	1,444	11,458	30,789	2,451
1991	102,531	148,347	100,898	1,008	3,942	806	1,449	12,098	31,388	2,535
1992	NA		NA	NA	NA	NA	NA	14,092	31,940	NA
Total, all fields										
1981	65,754	472,541	65,754	NA	NA	NA	NA	NA	39,369	NA
1982	72,247	486,500	72,247	NA	NA	NA	NA	NA	44,115	NA
1983	77,354	497,284	77,354	NA	NA	NA	NA	NA	47,418	NA
1984	78,706	499,595	78,706	NA	NA	NA	NA	NA	49,264	NA
1985	209,045	504,217	199,826	3,428	6,889	3,322	5,054	NA	50,418	NA
1986	215,463	510,061	206,592	3,701	6,226	3,244	5,330	NA	52,085	NA
1987	232,132	518,529	220,164	4,211	6,146	3,101	5,518	NA	52,819	NA
1988	250,383	524,797	237,726	3,605	11,080	3,078	5,982	NA	53,725	NA
1989	261,368	542,605	248,130	4,457	10,505	6,179	5,986	NA	53,901	NA
1990	323,935	566,284	309,167	4,553	10,505	6,733	6,169	29,180	67,395	9,395
1991	356,398	599,045	340,221	4,673	10,505	6,935	6,153	48,200	69,010	10,019
1992	NA		NA	NA	NA	NA	NA	NA	69,751	NA

See explanatory information and SOURCES at end of table.

Appendix table 18. First university degrees in science and engineering earned by women in selected European countries and the United States: 1981-92

Year	Ireland	Italy	Netherlands	Portugal	Spain	Sweden	U.K.[2]	Total EFTA	Norway	Switzerland
					Science and engineering (including social science)					
1981	652	8,352	759	NA	8,879	NA	10,672	NA	NA	NA
1982	577	9,433	801	NA	7,574	NA	11,492	NA	NA	NA
1983	860	9,503	865	1,345	6,829	NA	12,481	NA	NA	NA
1984	941	9,302	907	1,276	7,050	NA	12,072	885	181	704
1985	1,087	10,034	1,597	1,498	7,692	NA	12,464	930	348	582
1986	1,102	10,776	1,916	1,421	8,753	NA	12,698	980	362	618
1987	1,120	11,474	2,178	1,470	9,406	1,159	12,879	1,227	613	614
1988	1,138	12,304	2,752	1,652	9,432	1,252	13,088	1,383	682	701
1989	1,158	13,719	2,771	1,864	9,889	1,339	13,461	1,554	790	764
1990	1,179	14,007	2,608	2,158	11,071	1,352	13,360	1,518	750	768
1991	1,201	14,284	2,488	2,158	11,487	2,066	13,988	1,633	809	824
1992	NA	15,788	NA	NA	NA	NA	28,400	NA	NA	897
					Total, all fields					
1981	NA	NA	NA	NA	NA	NA	26,385	NA	NA	NA
1982	NA	NA	NA	NA	NA	NA	28,132	NA	NA	NA
1983	NA	NA	NA	NA	NA	NA	29,936	NA	NA	NA
1984	NA	NA	NA	NA	NA	NA	29,442	NA	NA	NA
1985	NA	31,327	5,091	5,512	49,112	9,649	30,024	9,219	6,990	2,229
1986	NA	33,387	5,797	5,098	53,099	8,965	29,660	8,871	6,562	2,309
1987	NA	35,274	7,121	6,141	60,256	9,110	30,467	11,968	9,510	2,458
1988	NA	36,651	10,874	6,570	65,193	9,467	31,501	12,657	10,047	2,610
1989	NA	40,662	9,706	7,030	68,142	9,383	32,179	13,238	10,423	2,815
1990	4,599	42,393	7,915	7,083	70,695	8,686	33,866	14,768	11,939	2,829
1991	4,511	45,530	8,451	7,083	74,939	8,814	35,398	16,177	13,104	3,073
1992	NA	49,706	NA	NA	NA	NA	84,800	NA	NA	3,272

EU = European Union; EFTA = European Free Trade Association; NA = not available

NOTES: Data are compiled from numerous national and international sources, and degree fields may not be strictly comparable. Detailed national education data were available for Austria, France, Germany, Switzerland, the United Kingdom, and the United States. These data were reconfigured to the International Standard Classification of Instructional Programs. First university degrees in different countries are of different duration and may not be academically equivalent. Data for Germany include East and West German data for 1990-92; prior years (1975-89) include only West German data. Data for the United Kingdom and the Netherlands do not include open universities. See Notes on Data Series for degrees included in first university degrees.

[1] Natural sciences in this table include mathematics and computer science and agricultural sciences, as well as physical, biological, and environmental sciences. For a breakout of mathematics and computer science and agricultural science from natural sciences, see appendix table 16.

[2] U.K. 1992 data contain polytechnics brought into the university system.

SOURCES: Organisation for Economic Co-operation and Development (OECD), Center for Research and Innovation (CERI) "Education at a Glance" database, 1994; United Nations Educational, Scientific, and Cultural Organization, *Statistical Yearbook*, annual series, supplemented by national sources: Austria—Population Division, Austrian Central Statistical Office, unpublished tabulations; France—Ministère de l'Education Nationale, *Repères et Références: Statistiques sur les Enseignements;* Germany—Statistisches Bundesamt Wiesbaden, *Prüfungen an Hochschulen;* Switzerland—Federal Office of Statistics, Education and Society Division, Universities and Science Section, unpublished tabulations; United Kingdom—University Grants Committee, *University Statistics*, Universities Statistical Record, and the Department of Education and Science, unpublished tabulations; United States—National Science Foundation, Science Resources Studies Division, *Science and Engineering Degrees: 1966-93,* NSF 95-312 (Arlington, VA: NSF, 1995). For additional national sources, see Contacts and References.

Appendix table 19. Doctoral degrees in science and engineering in Germany and the United Kingdom, by sex and field: 1975-92

Sex and field	1975	1976	1977	1978	1979	1980	1981	1982	1983
Germany									
Total, all degrees	11,418	11,531	11,386	11,755	11,939	12,222	12,283	12,963	13,637
Total natural sciences	2,818	2,961	3,060	2,856	2,934	3,020	2,974	2,935	3,039
Natural sciences	2,238	2,364	2,443	2,287	2,380	2,462	2,444	2,313	2,404
Math/computer science	242	250	294	242	273	227	213	261	274
Agricultural science	338	347	323	327	281	331	317	361	361
Social science	1,015	1,042	1,024	995	959	949	913	1,012	966
Engineering	755	739	838	826	928	811	823	990	973
Females, all degrees	1,799	1,780	1,791	1,910	2,213	2,392	2,491	2,712	3,048
Total natural sciences	255	232	295	267	351	360	384	400	477
Natural sciences	214	198	262	226	292	321	319	325	381
Math/computer science	27	14	12	18	21	11	19	20	22
Agricultural science	14	20	21	23	38	28	46	55	74
Social science	120	133	141	100	118	135	136	184	181
Engineering	25	15	5	3	8	9	9	11	19
Males, all degrees	9,619	9,751	9,595	9,845	9,726	9,830	9,792	10,251	10,589
Total natural sciences	2,563	2,729	2,765	2,589	2,583	2,660	2,590	2,535	2,562
Natural sciences	2,024	2,166	2,181	2,061	2,088	2,141	2,125	1,988	2,023
Math/computer science	215	236	282	224	252	216	194	241	252
Agricultural science	324	327	302	304	243	303	271	306	287
Social science	895	909	883	895	841	814	777	828	785
Engineering	730	724	833	823	920	802	814	979	954
United Kingdom									
Total, all degrees	5,341	5,210	5,331	5,601	5,700	5,804	5,983	6,333	6,528
Total natural sciences	2,533	2,501	2,645	2,663	2,761	2,732	2,895	3,001	2,898
Natural sciences	2,082	2,070	2,155	2,192	2,303	2,300	2,389	2,515	2,426
Math/computer science	242	264	282	277	273	256	311	296	289
Agricultural science	209	167	208	194	185	176	195	190	183
Social science	431	475	513	539	495	532	541	603	663
Engineering	1,059	1,005	957	1,033	966	1,023	1,027	1,134	1,198
Females, all degrees	726	718	769	883	978	1,071	1,132	1,222	1,306
Total natural sciences	312	323	361	437	454	489	531	563	560
Natural sciences	265	277	318	370	391	418	452	505	491
Math/computer science	22	23	14	30	35	26	38	25	26
Agricultural science	25	23	29	37	28	45	41	33	43
Social science	88	102	103	117	140	115	150	163	193
Engineering	24	39	35	43	41	50	61	83	73
Males, all degrees	4,615	4,492	4,562	4,718	4,722	4,733	4,851	5,111	5,222
Total natural sciences	2,221	2,178	2,284	2,226	2,307	2,243	2,364	2,438	2,338
Natural sciences	1,817	1,793	1,837	1,822	1,912	1,882	1,937	2,010	1,935
Math/computer science	220	241	268	247	238	230	273	271	263
Agricultural science	184	144	179	157	157	131	154	157	140
Social science	343	373	410	422	355	417	391	440	470
Engineering	1,035	966	922	990	925	973	966	1,051	1,125

Appendix table 19. Doctoral degrees in science and engineering in Germany and the United Kingdom, by sex and field: 1975-92

Sex and field	1984	1985	1986	1987	1988	1989	1990	1991	1992
Germany									
Total, all degrees	14,133	14,951	15,530	16,064	17,321	17,901	22,372	22,462	21,438
Total natural sciences	2,965	3,674	3,868	4,202	4,626	4,996	6,745	6,453	6,704
Natural sciences	2,315	2,986	3,184	3,440	3,844	4,095	5,319	5,326	5,638
Math/computer science	239	274	278	294	332	383	429	418	464
Agricultural science	411	414	406	468	450	518	997	709	602
Social science	1,014	968	1,064	1,068	1,150	1,200	1,544	1,483	1,344
Engineering	1,174	1,096	1,159	1,306	1,325	1,372	2,473	2,529	2,100
Females, all degrees	3,278	3,598	3,920	4,228	4,547	4,755	6,367	6,645	6,186
Total natural sciences	556	618	748	847	906	1,083	1,492	1,592	1,602
Natural sciences	474	539	664	734	800	897	1,242	1,322	1,362
Math/computer science	23	22	26	26	33	51	39	40	65
Agricultural science	59	57	58	87	73	135	211	230	175
Social science	158	170	184	198	223	247	357	350	268
Engineering	19	27	24	45	50	38	153	177	114
Males, all degrees	10,855	11,353	11,610	11,836	12,774	13,146	16,005	15,817	15,252
Total natural sciences	2,409	3,056	3,120	3,355	3,720	3,913	5,253	4,861	5,102
Natural sciences	1,841	2,447	2,520	2,706	3,044	3,198	4,077	4,004	4,276
Math/computer science	216	252	252	268	299	332	390	378	399
Agricultural science	352	357	348	381	377	383	786	479	427
Social science	856	798	880	870	927	953	1,187	1,133	1,076
Engineering	1,155	1,069	1,135	1,261	1,275	1,334	2,320	2,352	1,986
United Kingdom									
Total, all degrees	6,291	6,208	6,492	6,835	7,588	7,845	8,242	8,387	8,396
Total natural sciences	2,921	2,850	3,045	3,096	3,405	3,590	3,825	3,934	3,852
Natural sciences	2,408	2,409	2,495	2,583	2,787	2,937	3,113	3,151	3,054
Math/computer science	290	282	290	321	374	415	471	535	519
Agricultural science	223	159	260	192	244	238	241	248	279
Social science	657	687	686	732	899	878	916	914	935
Engineering	989	1,071	1,028	1,188	1,359	1,348	1,466	1,454	1,325
Females, all degrees	1,415	1,413	1,491	1,672	1,821	1,961	2,000	2,131	2,356
Total natural sciences	618	641	680	690	805	900	873	997	1,040
Natural sciences	521	552	578	598	676	761	738	837	862
Math/computer science	39	44	43	48	55	64	76	86	80
Agricultural science	58	45	59	44	74	75	59	74	98
Social science	222	230	227	243	272	280	292	289	351
Engineering	66	64	65	87	106	137	137	147	145
Males, all degrees	4,876	4,795	5,001	5,163	5,767	5,884	6,242	6,256	6,040
Total natural sciences	2,303	2,209	2,365	2,406	2,600	2,690	2,952	2,937	2,812
Natural sciences	1,887	1,857	1,917	1,985	2,111	2,176	2,375	2,314	2,192
Math/computer science	251	238	247	273	319	351	395	449	439
Agricultural science	165	114	201	148	170	163	182	174	181
Social science	435	457	459	489	627	598	624	625	584
Engineering	923	1,007	963	1,101	1,253	1,211	1,329	1,307	1,180

SOURCES: Government of the United Kingdom, Department for Education, 1993, Universities Statistical Record, unpublished tabulations; Government of the Federal Republic of Germany, Federal Ministry of Education and Science, 1993, Statistisches Bundesamt Wiesbaden, *Prüfungen an Hochschulen*.

Appendix table 20. Share of science and engineering degrees obtained by males and females in selected European countries and the United States: 1992 or most current year

Region/country	Natural sciences	Math/comp. science	Agricultural science	Social science	Engineering
			Male		
Asia					
Japan	81	79	78	85	96
South Korea	56	59	67	78	94
European Union					
Austria	65	76	67	40	93
Finland	48	88	59	33	87
Denmark	70	NA	47	57	81
France	66	NA	NA	53	81
Germany	60	75	53	56	89
Greece	57	59	61	49	78
Ireland	50	71	64	39	87
Italy	46	49	71	54	92
Netherlands	70	86	77	70	89
Portugal	31	56	38	37	70
Spain	50	60	63	27	90
Sweden	46	70	58	22	79
United Kingdom	56	66	50	51	74
European Free Trade Association					
Norway	64	69	96	72	78
Switzerland	73	86	62	46	97
Central Europe					
Bulgaria	30	27	60	44	51
Czech Republic	45	74	62	32	78
Hungary	63	80	76	57	88
Poland	29	37	61	36	82
Slovak Republic	38	59	56	24	70
United States	58	64	62	45	84
			Female		
Asia					
Japan	19	21	22	15	4
South Korea	43	41	33	22	6
European Union					
Austria	35	24	33	60	7
Finland	52	12	41	67	13
Denmark	30	NA	53	42	19
France	35	NA	NA	47	19
Germany	40	25	47	44	11
Greece	43	41	39	51	23
Ireland	50	29	36	61	13
Italy	55	51	29	46	8
Netherlands	30	14	23	30	11
Portugal	69	44	62	63	30
Spain	50	40	37	73	10
Sweden	54	30	42	78	21
United Kingdom	44	34	50	49	26
European Free Trade Association					
Norway	36	31	4	28	22
Switzerland	27	15	38	54	3
Central Europe					
Bulgaria	70	73	40	56	49
Czech Republic	55	26	38	68	22
Hungary	37	20	24	43	12
Poland	71	63	39	64	18
Slovak Republic	63	41	44	76	30
United States	42	36	38	55	16

NA = not available

NOTES: Data are compiled from numerous national and international sources, and degree fields may not be strictly comparable. First university degrees in different countries are of different duration and may not be academically equivalent. Data for Austria, Denmark, Finland, Greece, Ireland, the Netherlands, Portugal, Spain, Sweden, Norway, and Hungary are for 1991. All other country data are for 1992.

SOURCES: National sources.

Appendix table 21. Science and engineering degrees as a percentage of total first university degrees, by country and sex: 1992 or most current year

Region/country	Total S&E	Natural sciences	Social sciences	Engineering	Non-S&E
		Male			
Asia					
Japan	83	7	49	27	17
South Korea	55	15	13	27	45
European Union					
Austria	39	18	5	16	61
Denmark	55	10	7	38	45
Finland	65	20	4	41	35
France	50	19	7	24	50
Germany	67	17	19	31	33
Greece	49	20	11	18	51
Ireland	42	19	4	19	58
Italy	53	15	22	16	47
Netherlands	65	17	28	20	35
Portugal	42	17	8	17	58
Spain	31	14	3	14	69
Sweden	45	14	4	27	55
United Kingdom	46	19	13	15	53
European Free Trade Association					
Norway	31	4	6	21	69
Switzerland	38	18	7	13	62
Central Europe					
Bulgaria	44	10	2	32	56
Czech Republic	64	15	1	48	36
Hungary	37	13	5	19	63
Poland	41	13	3	25	59
Slovak Republic	70	14	0	56	30
United States	42	13	16	13	58
		Female			
Asia					
Japan	28	4	21	3	72
South Korea	25	16	6	3	75
European Union					
Austria	21	10	10	1	78
Denmark	15	3	4	8	85
Finland	23	9	8	6	77
France	25	11	7	7	75
Germany	45	16	23	6	54
Greece	27	12	10	5	73
Ireland	27	17	7	3	73
Italy	32	13	18	1	68
Netherlands	29	8	18	3	71
Portugal	30	15	10	5	70
Spain	15	8	5	2	85
Sweden	24	7	11	6	76
United Kingdom	33	14	14	6	66
European Free Trade Association					
Norway	6	1	1	4	94
Switzerland	27	11	15	1	73
Central Europe					
Bulgaria	36	10	2	24	65
Czech Republic	27	11	1	15	73
Hungary	10	4	4	2	90
Poland	20	12	4	4	80
Slovak Republic	38	12	0	26	62
United States	26	7	17	2	74

S&E = science and engineering

NOTES: Data are compiled from numerous national and international sources, and degree fields may not be strictly comparable. First university degrees in different countries are of different duration and may not be academically equivalent. Data for Austria, Denmark, Finland, Greece, Ireland, the Netherlands, Portugal, Spain, Sweden, Norway, and Hungary are for 1991. All other country data are for 1992.

SOURCES: National sources.

Appendix table 22. Ratio of science and engineering degrees to total first university degrees, by region/country: 1992 or most current year

Region/country	Total S&E	Natural sciences	Social sciences	Engineering	Non-S&E
Asia					
Total Asia	44	14	14	16	56
China	63	11	12	40	37
India	24	20	NA	4	76
Japan[1]	66	6	40	20	34
Singapore	43	21	2	20	57
South Korea	43	15	10	18	57
Taiwan	40	14	8	18	60
Europe					
Total Europe	41	14	11	16	59
European Union	42	15	13	14	58
Austria	32	15	7	10	68
Belgium	61	7	28	26	39
Denmark	34	8	5	21	66
Finland	45	15	6	24	55
France	38	15	7	16	62
Germany	60	17	21	22	40
Greece	38	16	11	11	62
Ireland	35	18	5	12	65
Italy	42	14	20	8	58
The Netherlands	50	13	24	13	50
Portugal	35	16	9	10	65
Spain	22	11	4	7	78
Sweden	33	10	8	15	67
United Kingdom	40	16	13	11	60
European Free Trade Association	21	7	5	9	79
Norway	15	2	3	10	85
Switzerland	34	16	10	8	66
Central Europe	42	11	2	28	58
Bulgaria	39	10	2	27	61
Czech Republic	47	13	1	33	53
Hungary	22	8	4	10	78
Poland	29	12	4	13	71
Romania	66	10	0	56	44
Slovak Republic	54	13	0	41	46
North America					
Total North America	32	9	15	8	68
Canada	34	10	18	6	66
Mexico	41	6	8	27	59
United States	31	10	16	5	69

S&E = science and engineering; NA = not available

[1] Japanese social sciences data include business administration.

SOURCE: Computed from data in appendix table 1.

Appendix table 23. Ratio of enrollments in higher education to the 20- to 24-year-old population in European countries and the United States: 1975-91

Year	Total Europe	United States	Total EU	Austria	Belgium	Denmark	Finland	France	Germany
1975	0.19	0.58	0.21	0.19	0.21	0.29	0.27	0.24	0.19
1976	0.20	0.54	0.22	0.20	0.22	0.30	0.29	0.25	0.19
1977	0.20	0.52	0.22	0.21	0.23	0.29	0.30	0.25	0.19
1978	0.20	0.49	0.23	0.22	0.24	0.29	0.31	0.25	0.20
1979	0.21	0.48	0.23	0.24	0.25	0.29	0.32	0.25	0.21
1980	0.21	0.57	0.23	0.23	0.25	0.29	0.32	0.25	0.20
1981	0.21	0.58	0.24	0.23	0.27	0.28	0.33	0.27	0.22
1982	0.21	0.59	0.24	0.24	0.28	0.29	0.33	0.28	0.23
1983	0.22	0.59	0.24	0.25	0.29	0.29	0.32	0.26	0.23
1984	0.22	0.58	0.25	0.26	0.31	0.29	0.32	0.29	0.23
1985	0.23	0.59	0.25	0.27	0.31	0.29	0.34	0.30	0.23
1986	0.23	0.61	0.26	0.28	0.32	0.30	0.36	0.30	0.24
1987	0.24	0.64	0.27	0.29	0.33	0.31	0.38	0.31	0.25
1988	0.25	0.67	0.28	0.30	0.34	0.32	0.40	0.32	0.26
1989	0.26	0.71	0.30	0.31	0.36	0.34	0.43	0.37	0.27
1990	0.28	0.72	0.32	0.32	0.38	0.36	0.47	0.39	0.28
1991	0.30	0.77	0.35	0.35	0.38	0.38	0.49	0.43	0.31

	Greece	Ireland	Italy	Nether-lands	Portugal	Spain	Sweden	U.K.
1975	0.18	0.19	0.26	0.25	0.11	0.20	0.29	0.19
1976	0.19	0.19	0.26	0.27	0.13	0.22	0.30	0.19
1977	0.18	0.19	0.27	0.28	0.12	0.23	0.31	0.19
1978	0.18	0.20	0.27	0.29	0.12	0.24	0.31	0.20
1979	0.18	0.21	0.28	0.30	0.11	0.25	0.31	0.20
1980	0.17	0.20	0.28	0.30	0.11	0.24	0.31	0.20
1981	0.18	0.22	0.27	0.31	0.11	0.24	0.31	0.20
1982	0.19	0.23	0.26	0.31	0.12	0.25	0.32	0.20
1983	0.21	0.23	0.26	0.31	0.12	0.26	0.32	0.22
1984	0.23	0.24	0.26	0.31	0.13	0.27	0.32	0.22
1985	0.25	0.24	0.25	0.32	0.12	0.29	0.31	0.22
1986	0.27	0.25	0.25	0.32	0.15	0.30	0.31	0.23
1987	0.25	0.25	0.26	0.33	0.16	0.32	0.31	0.23
1988	0.25	0.26	0.28	0.33	0.17	0.34	0.31	0.24
1989	0.25	0.27	0.29	0.35	0.19	0.36	0.31	0.26
1990	0.25	0.30	0.31	0.38	0.23	0.37	0.31	0.28
1991	0.25	0.32	0.33	0.41	0.23	0.39	0.34	0.31

See explanatory information and SOURCES at end of table.

Appendix table 23. Ratio of enrollments in higher education to the 20- to 24-year-old population in European countries and the United States: 1975-91

Year	Total EFTA	Norway	Switzer-land	Central Europe	Bulgaria	Czecho-slovakia	Hungary	Poland	Romania
1975	0.12	0.22	0.14	0.15	0.19	0.12	0.12	0.17	0.09
1976	0.13	0.24	0.15	0.16	0.20	0.13	0.12	0.18	0.10
1977	0.13	0.25	0.16	0.16	0.19	0.14	0.12	0.18	0.10
1978	0.14	0.25	0.17	0.16	0.18	0.15	0.13	0.18	0.10
1979	0.15	0.26	0.17	0.16	0.17	0.16	0.13	0.18	0.11
1980	0.15	0.26	0.18	0.16	0.16	0.17	0.13	0.18	0.11
1981	0.15	0.27	0.19	0.16	0.16	0.17	0.14	0.17	0.11
1982	0.15	0.29	0.19	0.16	0.15	0.17	0.14	0.16	0.11
1983	0.15	0.29	0.19	0.16	0.16	0.16	0.14	0.16	0.11
1984	0.16	0.30	0.21	0.16	0.17	0.16	0.15	0.16	0.11
1985	0.17	0.30	0.21	0.16	0.19	0.16	0.15	0.17	0.11
1986	0.18	0.33	0.23	0.16	0.21	0.16	0.15	0.17	0.10
1987	0.18	0.33	0.24	0.16	0.23	0.16	0.15	0.17	0.10
1988	0.19	0.35	0.25	0.16	0.23	0.17	0.15	0.19	0.09
1989	0.20	0.39	0.26	0.17	0.27	0.17	0.15	0.20	0.09
1990	0.21	0.42	0.27	0.17	0.33	0.18	0.15	0.22	0.09
1991	0.22	0.45	0.29	0.18	0.32	NA	0.15	0.12	0.11

EU = European Union; EFTA = European Free Trade Association; NA = not available

SOURCES: Calculated from appendix tables 1 and 12.

Appendix table 24. Enrollment in higher education in European countries and the United States, by type of institution: 1991

Country	Total	University	Percentage of total	Non-university	Percentage of total
Total Europe	11,447,525	8,084,623	71	2,654,735	23
European Union	9,932,463	7,055,792	71	2,348,609	24
Austria	216,529	201,518	93	14,914	7
Belgium	276,248	111,845	40	164,403	60
Denmark	150,159	124,942	83	25,217	17
Finland	173,702	115,358	66	58,344	34
France	1,840,307	1,246,989	68	593,318	32
Germany	1,867,491	1,539,394	82	228,028	12
Greece	195,213	116,906	60	78,307	40
Ireland	101,108	52,288	52	48,820	48
Italy	1,533,202	1,522,824	99	10,378	1
Netherlands[1]	493,563	198,442	40	259,865	53
Portugal	190,856	150,510	79	40,346	21
Spain[1]	1,301,748	1,206,681	93	8,947	1
Sweden	207,265	NA	NA	NA	NA
United Kingdom[1]	1,385,072	468,095	34	817,722	59
European Free Trade Association	300,247	157,280	52	139,967	47
Norway	154,180	68,249	44	85,931	56
Switzerland	146,067	89,031	61	54,036	37
Central Europe	1,214,815	871,551	72	166,159	14
Bulgaria	185,914	156,247	84	29,672	16
Czechoslovakia (former)	177,110	NA	NA	NA	NA
Hungary	107,079	71,452	67	35,627	33
Poland	535,656	434,796	81	100,860	19
Romania	209,056	209,056	100	0	0
United States	14,527,881	8,265,794	57	6,262,087	43

NA = not available

[1] Distance learning institutions, a third category of higher education, are a small percentage of higher education enrollments in the Netherlands (7 percent), Spain (6 percent), and the U.K. (7 percent).

SOURCE: United Nations Educational, Scientific, and Cultural Organization, 1993, *Statistical Yearbook 1993,* Paris.

Appendix table 25. Participation rate of college age cohort in first university degrees in the natural sciences and engineering, by sex and country: 1992 or most current year

Region/country	Degree fields				24-year-olds			
	All first univ. degrees	Natural sciences	Social sciences	Engineering	Total number	With first univ. degree	With NS&E degree	With soc. sci. degree
	Number					Percent		
Male								
Asia								
Japan	307,586	20,921	150,758	85,027	957,251	32.3	11.1	15.8
South Korea	109,498	15,456	14,151	29,821	453,384	24.2	10.1	3.1
European Union								
Austria	5,996	1,071	301	978	64,130	9.3	3.2	0.5
Finland	6,233	1,257	246	2,549	35,180	17.7	10.8	0.7
Denmark	5,607	537	385	2,158	39,866	14.1	6.8	1.0
France	55,637	10,416	3,925	13,394	438,999	12.7	5.4	0.9
Germany	111,894	18,475	20,829	34,634	706,885	15.8	7.5	2.9
Greece	8,600	1,731	969	1,547	80,184	10.7	4.1	1.2
Ireland	4,898	954	191	955	32,104	15.3	5.9	0.6
Italy	46,519	6,779	10,447	7,345	468,949	9.9	3.0	2.2
Netherlands	12,261	2,080	3,473	2,466	123,660	9.9	3.7	2.8
Portugal	4,970	821	416	860	83,560	5.9	2.0	0.5
Spain	53,848	7,730	1,495	7,778	338,040	15.9	4.6	0.4
Sweden	7,118	981	262	1,899	62,227	11.4	4.6	0.4
United Kingdom	46,888	12,963	6,536	8,647	437,232	21.4	7.2	2.8
European Free Trade Association								
Norway	7,815	344	432	1,614	34,632	22.6	5.7	1.2
Switzerland	5,893	1,088	429	751	55,554	10.6	3.3	0.8
Central Europe								
Bulgaria	10,296	1,047	201	3,337	59,922	17.2	7.3	0.3
Czech Republic	9,606	1,440	53	4,601	74,735	12.9	8.1	0.1
Hungary	6,084	777	321	1,131	71,629	8.5	2.7	0.4
Poland	24,525	3,309	752	6,100	265,441	9.2	3.5	0.3
Slovak Republic	5,484	748	6	3,059	39,977	13.7	9.5	0.0
United States	525,395	70,219	83,261	52,305	1,916,494	27.4	6.4	4.3
Female								
Asia								
Japan	128,166	5,539	26,482	3,358	911,051	14.1	0.9	2.9
South Korea	66,088	11,229	4,100	1,979	453,384	15.8	3.0	1.0
European Union								
Austria	4,673	481	457	70	60,796	7.7	0.9	0.8
Finland	6,153	561	498	390	33,627	18.3	2.8	1.5
Denmark	6,935	231	285	521	38,191	18.2	2.0	0.7
France	48,200	5,484	3,419	3,195	420,876	11.5	2.1	0.8
Germany	69,751	11,425	16,297	4,218	669,172	10.4	2.3	2.4
Greece	9,832	1,228	998	450	74,758	13.2	2.2	1.3
Ireland	4,511	760	300	141	30,140	15.0	3.0	1.0
Italy	49,706	6,369	8,864	555	452,059	11.0	1.5	2.0
Netherlands	8,451	695	1,500	293	118,030	7.2	0.8	1.3
Portugal	7,083	1,083	713	362	81,239	8.7	1.8	0.9
Spain	74,939	6,048	4,024	1,415	321,999	23.3	2.3	1.2
Sweden	8,814	594	938	518	58,141	15.2	1.9	1.6
United Kingdom	38,005	7,368	6,855	1,398	416,872	20.3	4.1	2.8
European Free Trade Association								
Norway	13,104	175	168	466	33,800	38.8	1.9	0.5
Switzerland	3,272	376	495	26	54,559	6.0	0.7	0.9
Central Europe								
Bulgaria	13,590	1,341	259	3,211	57,259	23.7	7.9	0.5
Czech Republic	8,551	911	111	1,314	71,452	12.0	3.1	0.2
Hungary	6,994	284	245	161	66,751	10.5	0.7	0.4
Poland	30,835	3,551	1,329	1,340	252,900	12.2	1.9	0.5
Slovak Republic	5,183	641	19	1,335	38,650	13.4	5.1	0.0
United States	624,677	46,526	103,324	9,636	1,847,991	33.8	3.0	5.6

NS&E = natural sciences and engineering

NOTES: Data are compiled from numerous national and international sources, and degree fields may not be strictly comparable. First university degrees in different countries are of different duration and may not be academically equivalent. Data for Denmark, Greece, Ireland, the Netherlands, Portugal, Spain, Austria, Finland, Norway, Sweden, and Hungary are for 1991. All other country data are for 1992.

SOURCES: National sources.

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