

Some background statistical data reflecting on graduate degrees in natural sciences.

A selection of information is given below extracted from NSF, NAS and other publications referenced at the end. The selection (within what was available)and the appended comments in braces are by Gabor Vali. The lack of data on M.S. graduates is a problem. Date of this compilation: Feb. 23, 2000.

1. How did the US compare with other countries in the production of the first university degrees in natural sciences (NS), mathematics plus computer sciences (MC) and engineering (E) in 1998 ? NS includes earth, atmospheric, oceanographic, biological and agricultural sciences.

| | US | Europe | Asia |
|--|-----|--------|------|
| % of 24-year olds with first degrees in NS & E | 5.4 | 5.7 | 1.3 |
| % first degrees given in NS & MC | 11 | 18 | 15 |

Source: Appendix Table 2-1 of Ref. 1.

{This seems to indicate that there is lesser concentration of NS degrees in the US than in the comparison regions. At least with comparison to Europe the graduation rate as a whole is comparable.}

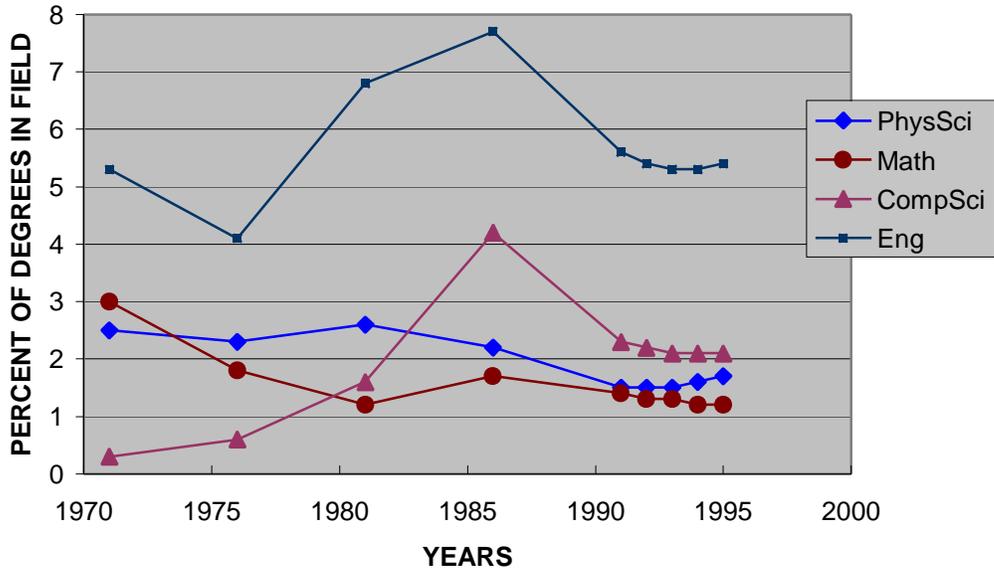
2. How did the proportion of natural science and engineering degrees (NS&E) change with time among 24-year olds?

| | 1975-1985 | 1994-1995 | % change |
|----------------------|-----------|-----------|----------|
| United Kingdom | 2.9 | 8.5 | 293 |
| South Korea | 2.1 | 7.6 | 361 |
| Japan | 4.7 | 6.4 | 136 |
| Taiwan | 2.6 | 6.4 | 246 |
| Germany | 3.4 | 5.8 | 170 |
| United States | 4.0 | 5.4 | 135 |
| France | 2.0 | 5.0 | 250 |

Source: page 2-9 of Ref. 1.

{This table underscores the point made with the previous table, and also shows that the rate of increase in NS&E degrees in the US is not impressive.}

Another set of numbers is available from the Department of Education. These show the numbers of bachelor's degrees awarded in various disciplines. The graphs below shows some of these data (source: indicator 29 of ref. 6):



{Physical sciences are showing a slight increase over the first half of the '90s but are still well below '70s levels. Mathematics is even worse. In actual numbers for 1995, the physical sciences had 19,000, mathematics 13,000, computer sciences 24,000 and engineering 62,000 bachelor's degrees.}

3. What fraction of US degrees were in NS in 1995?

| | NS | MC | E |
|---------------------|-------|-------|-------|
| Bachelor's degrees: | 7.7 % | 3.3 % | 5.4 % |
| Master's degrees: | 3.7 % | 3.6 % | 7.2 % |
| Doctoral degrees: | 23 % | 4.6 % | 14 % |

Source: Appendix Table 2-9 of Ref. 1.

{Not very revealing numbers, except perhaps for what the large changes indicate in the NS fraction with advancing levels. Otherwise just reference numbers for orientation.}

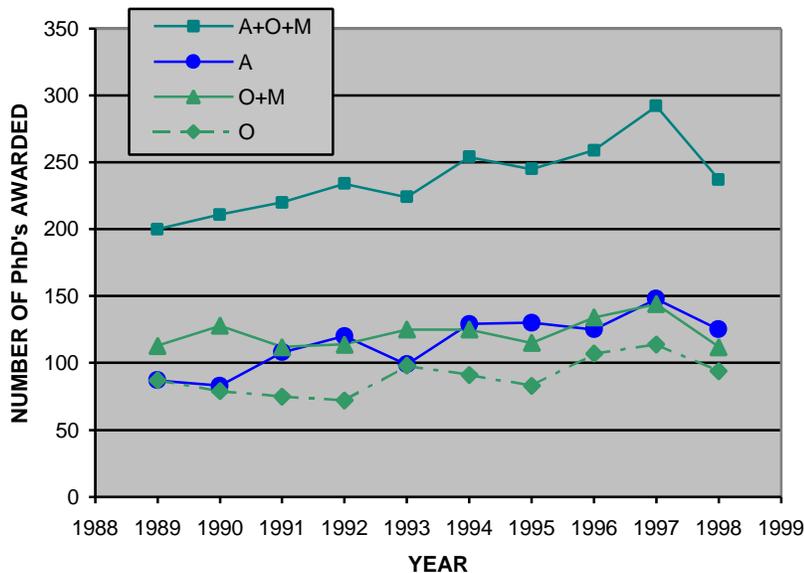
4. What was the time trend in the number of PhD degrees in NS?

| | 1977 | 1985 | 1991 | 1995 |
|-------------------------|-------|-------|--------|--------|
| Number of PhD in NS | 7,676 | 8,436 | 10,159 | 11,024 |
| % PhD's in NS | 24.2 | 27.0 | 27.1 | 26.5 |
| % NS PhD's UScit.+ p.r. | 83.7 | 78.6 | 69.5 | 75.8 |

Source: Appendix Tables 2-31 and 2-35 of Ref. 1.

{The overall increase in the NS doctoral degrees is a good sign, as is the steady fraction of the total doctoral degrees that are in NS. There is a fairly clear change in the fraction of US citizens plus permanent residents included in the pool of NS PhD's. That signal is even stronger if just US citizens are considered: 59.8 % in 1995}

5. The chart below shows the number of PhD degrees awarded in atmospheric sciences (A), in oceanography (O) (including marine sciences (M) and without it) and the sum of all these. The categories were defined by the available data. The atmospheric sciences data are broken down into many categories in the original table, but are not displayed here. For comparison, all science doctorates increased at an average rate of 2.2% per year over the same period and showed no decline in 1998. The 1997 to 1998 change is -20% for A, -21% in O. For physics it was -1.8 %; for mathematics and computer sciences it was +3.5 %. Of all major categories included in the listing, atmospheric and oceanic sciences show by far the largest decreases over these two years.



Source: Table 1 of Ref. 2.

{The gradual increase until 1997 is what we all remember. The sudden drop in 1998 is perhaps the first sign of the current situation of decreased enrollments. If so, and a single points risks being a false indicator, the signs of change were there some years ago.}

6. What's the employment picture for PhD's? According to a survey published by the AAAS, unemployment rates of 1996-97 PhDs as of October 1997 in the natural sciences range from 2 to 4.5 %. The rate is lowest for physics and highest for chemistry. Earth and space sciences (the only grouping reported containing the atmospheric and ocean sciences) reported 3.8 % unemployment rate (Ref. 3.)

Similar numbers are contained in the survey reported by the AGU, again for the 'earth and space sciences' category. The 1996 unemployment rate was 3 % and in 1997 it was 5 %. This report warns that there may be a bias in these numbers due to underreporting by the unemployed. (Ref. 4.)

7. Salary figures for *new* doctorates are more disturbing. The 'earth and space sciences' run considerably below other disciplines. The 9-10 month rate in education is one of the categories reported and represents well the overall picture. These rates are:

| | |
|----------------------|--------|
| Engineering | 50,000 |
| Chemical Engineering | 49,500 |
| Computer Science | 47,000 |
| Mathematics | 36,000 |
| Chemistry | 35,525 |
| Earth and space sci. | 33,000 |
| Microbiology | 33,000 |
| Physics | 33,000 |

Source: Ref. 3.

Another set of salary figures is available from the survey conducted by CORE (Ref. 5.) via graduation lists of 40 marine science institutions. Within 0-5 years of graduation Masters degree holders reported *annual salaries* centered on the \$25,000-\$37,500 range. For recent PhD degree graduates the mode is right around \$37,500.

REFERENCES:

- [1] National Science Board, *Science & Engineering Indicators - 1998*. Arlington, VA: National Science Foundation, 1998 (NSB 98-1)
- [2] National Science Foundation, Division of Science Resources Studies, *Science and Engineering Doctorate Awards : 1998*, Arlington, VA: (NSF 00-304)

- [3] *Employment of Recent Doctoral Graduates in Science and Engineering*. Commission on Professionals in Science and Technology (CPST), American Association for the Advancement of Science. <http://nextwave.sciencemag.org/survey/>
- [4] *Survey of Employment Experiences of Recent Doctoral Graduates in Earth and Space Sciences*. http://www.agu.org/sci_soc/cpst/employment_survey.html/ Go to the AGU homepage - <http://www.agu.org> click on Science & Society, then click on Careers in Science, then on Survey of Employment Experiences ... Space Sciences. (information courtesy E. Bierly)
- [5] *Alumni Survey of U.S. Marine Science & Policy Institutions*. CORE, October 1997.
- [6] U.S. Department of Education, National Center for Education Statistics, *The Condition of Education 1998*. <http://www.nces.ed.gov/pubs98/condition98/>