Remarks before the
Computing Research Association

The Adequacy of the U.S. S&E Workforce:

A QUANTITATIVE PERSPECTIVE

Offshore Outsourcing

John Sargent
Senior Policy Analyst
U.S. Department of Commerce

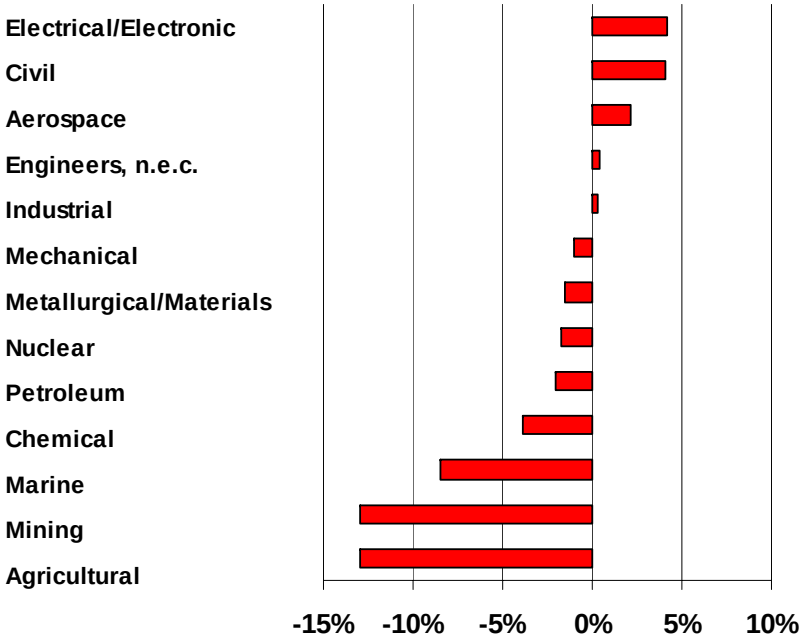
Alarm Bells…

- **"… the nation may likely face severe shortages in SET workers…"**
  - – ***Land of Plenty***, Commission on the Advancement of Women and Minorities in Science, Engineering, and Technology Development (CAWMSET)
- **"There is a quiet crisis building in the United States [that] stems from the gap between the nation's growing need for scientists, engineers, and other technically skilled workers, and its production of them."**
  - – **The Quiet Crisis: Falling Short in Producing American Scientific and Technical Talent**, Building Engineering and Science Talent (BEST)
- **"… U.S. need for the highest quality human capital in science, mathematics and engineering is not being met."**
  - **– Hart-Rudman Commission**
- **"Our 1998 study found a shortage of 346,000 programmers, systems analysts and computer scientists."**
  - – ITAA president Harris Miller
- **"We are not training enough American scientists and engineers to retain our prosperity …."**
  - – American Scientist magazine, 2001
- **"a serious deficit of scientists and engineers" resulting in "an evaporating dominance."**
  - – Dan Goldin, former NASA administrator, 2001

Demand for S&E Workers

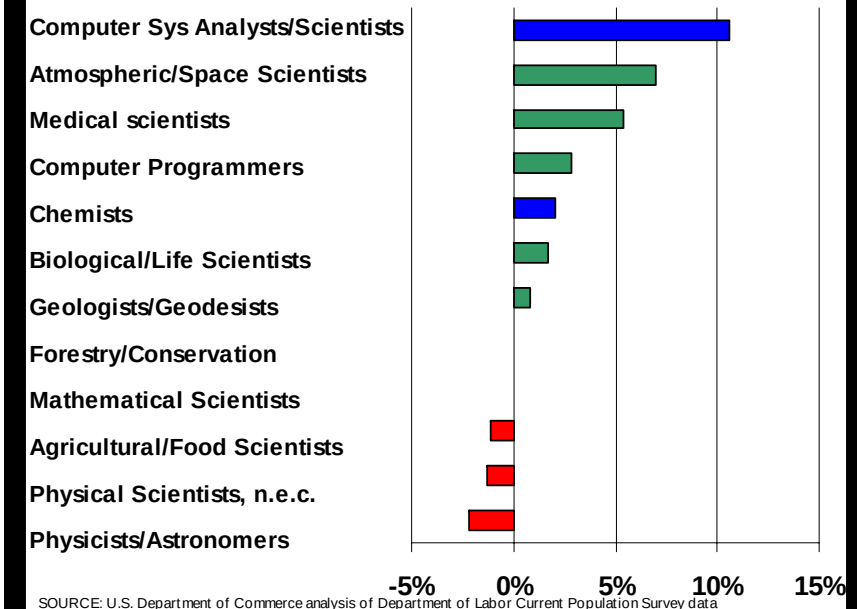
Recent Occupational Growth
Growth Rates

Engineering
Average Annual Employment Growth, 1996-2001



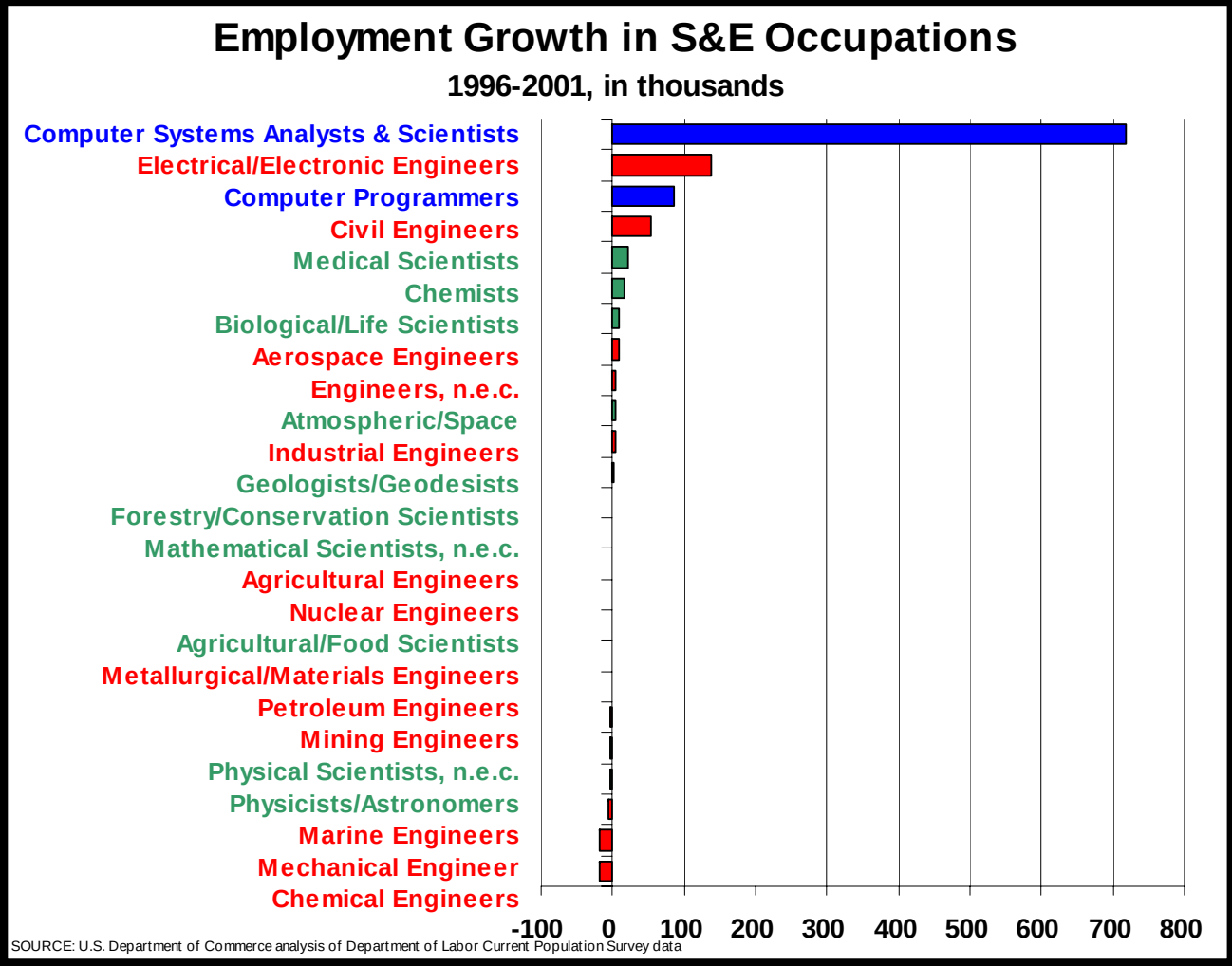
SOURCE: U.S. Department of Commerce analysis of Department of Labor Current Population Survey data

Physical/Life/Computer Sciences and Mathematics
Average Annual Employment Growth, 1996-2001

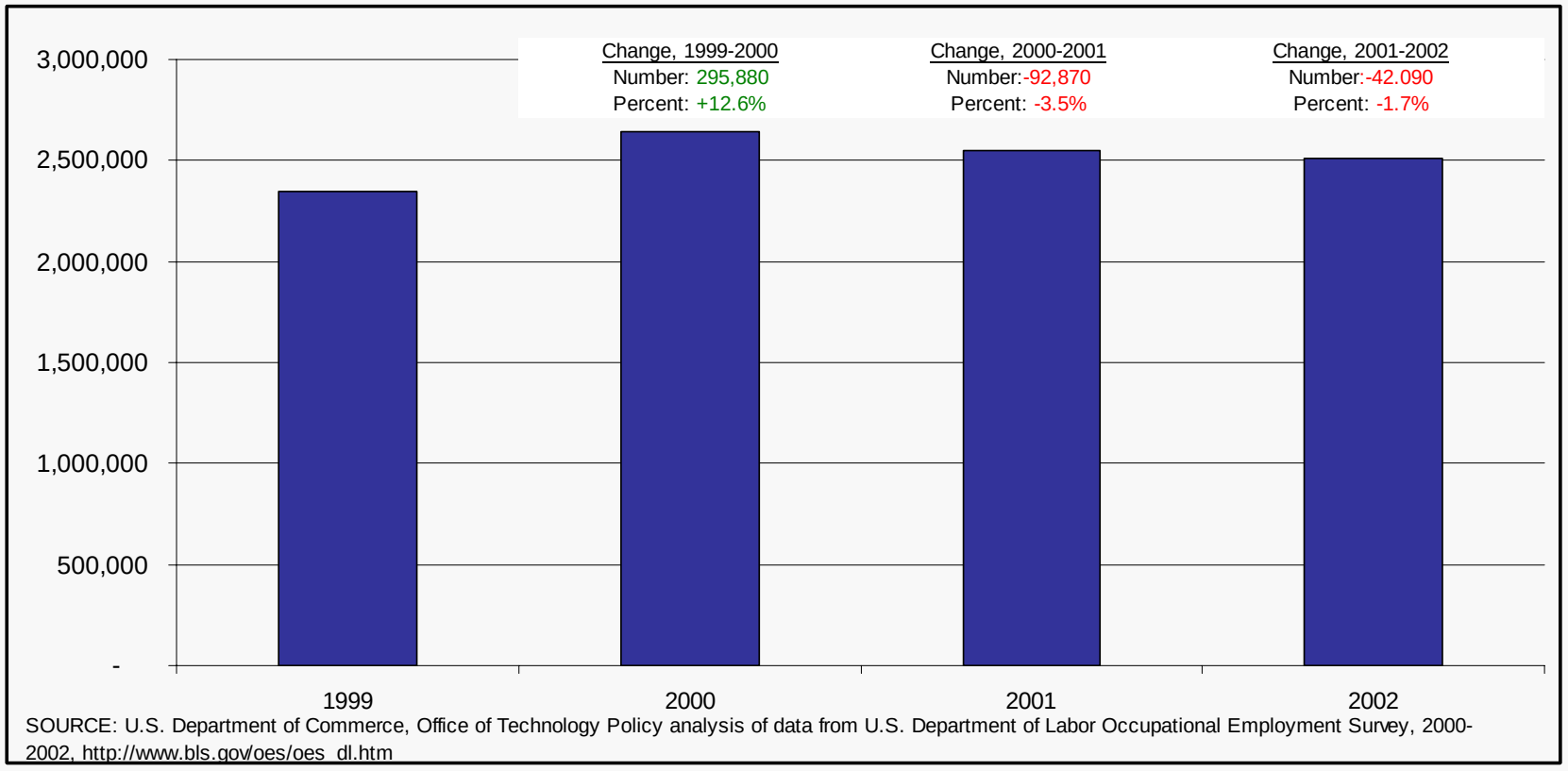


SOURCE: U.S. Department of Commerce analysis of Department of Labor Current Population Survey data

Recent Occupational Growth
Growth in Numbers

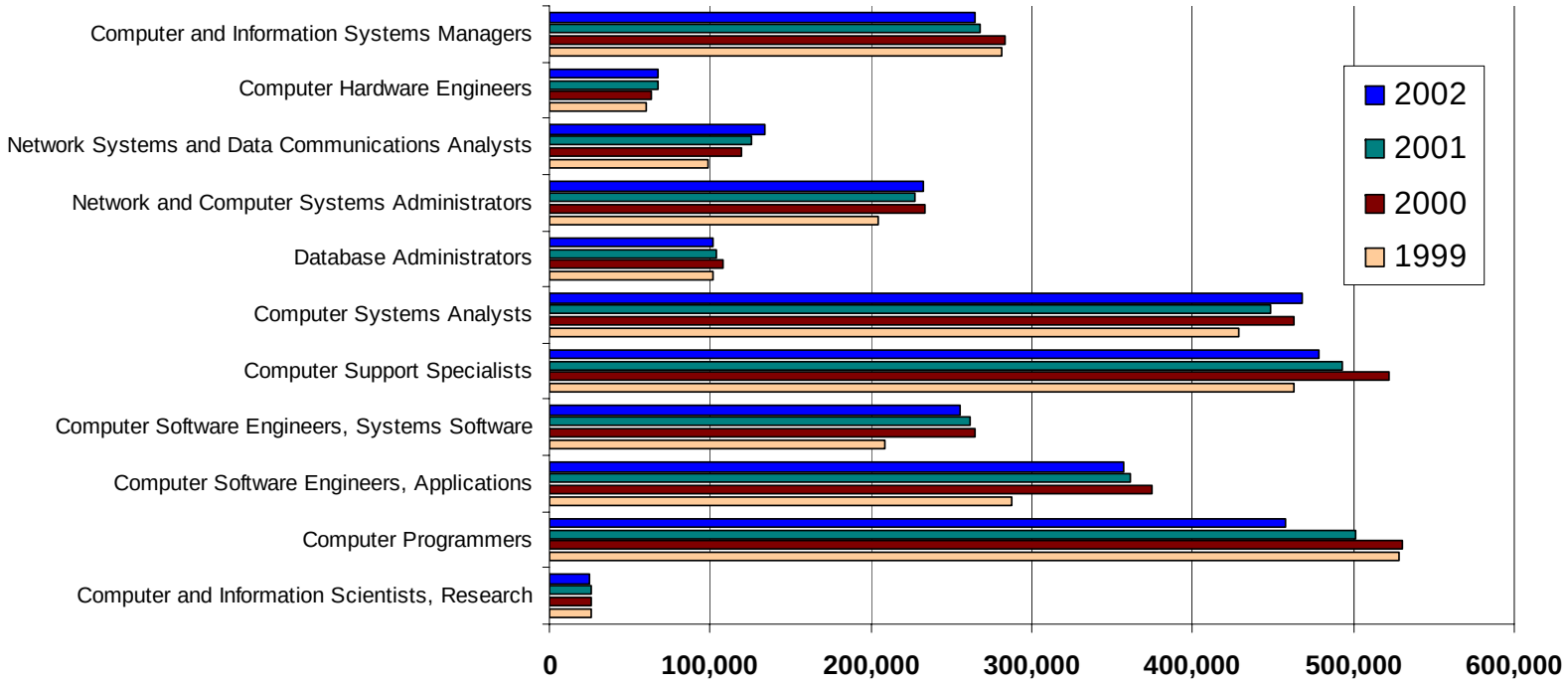


Aggregate IT Employment 1999-2002



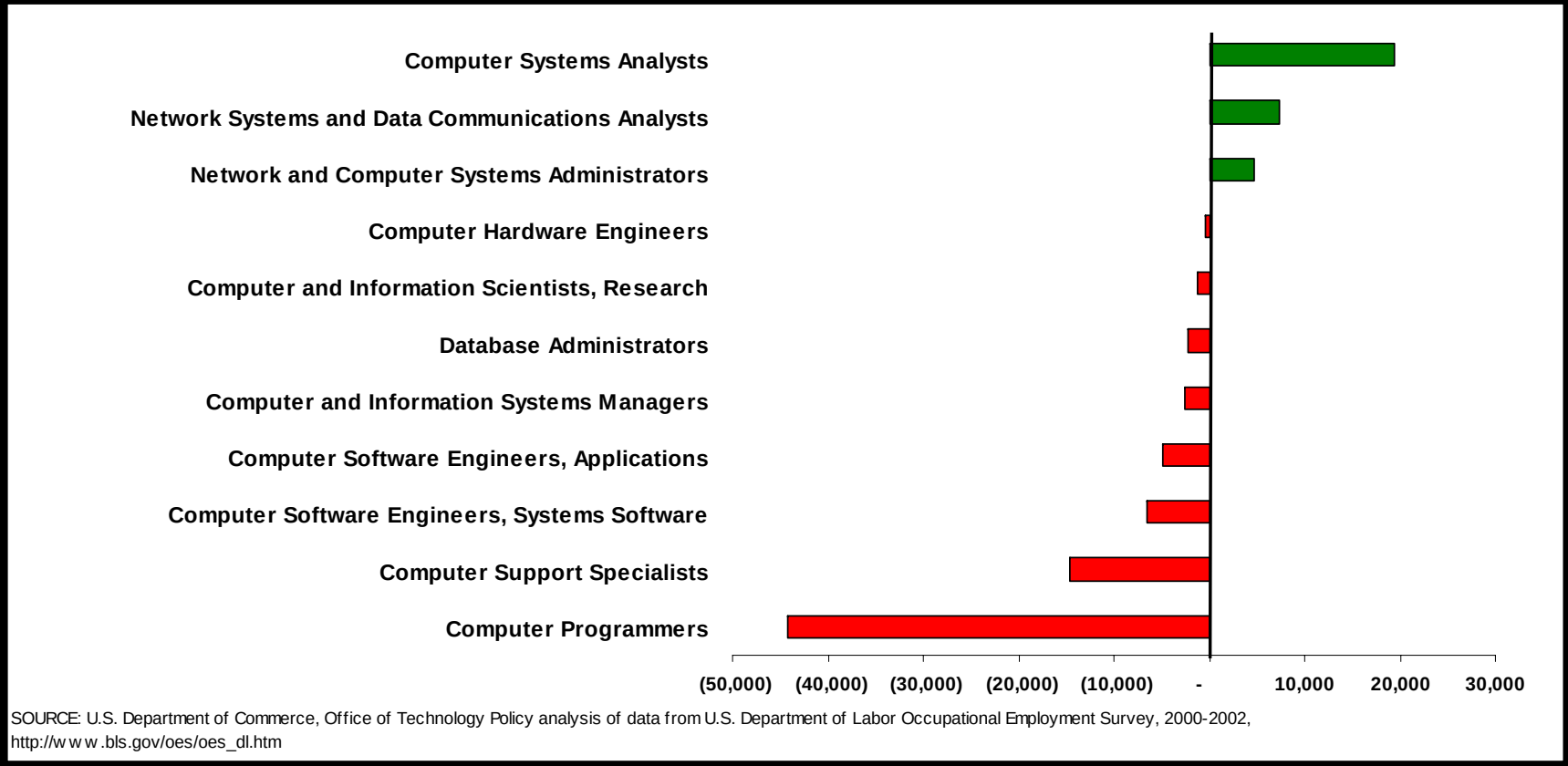
SOURCE: U.S. Department of Commerce, Office of Technology Policy analysis of data from U.S. Department of Labor Occupational Employment Survey, 2000-2002, http://www.bls.gov/oes/oes_dl.htm

IT Occupational Employment 1999-2002



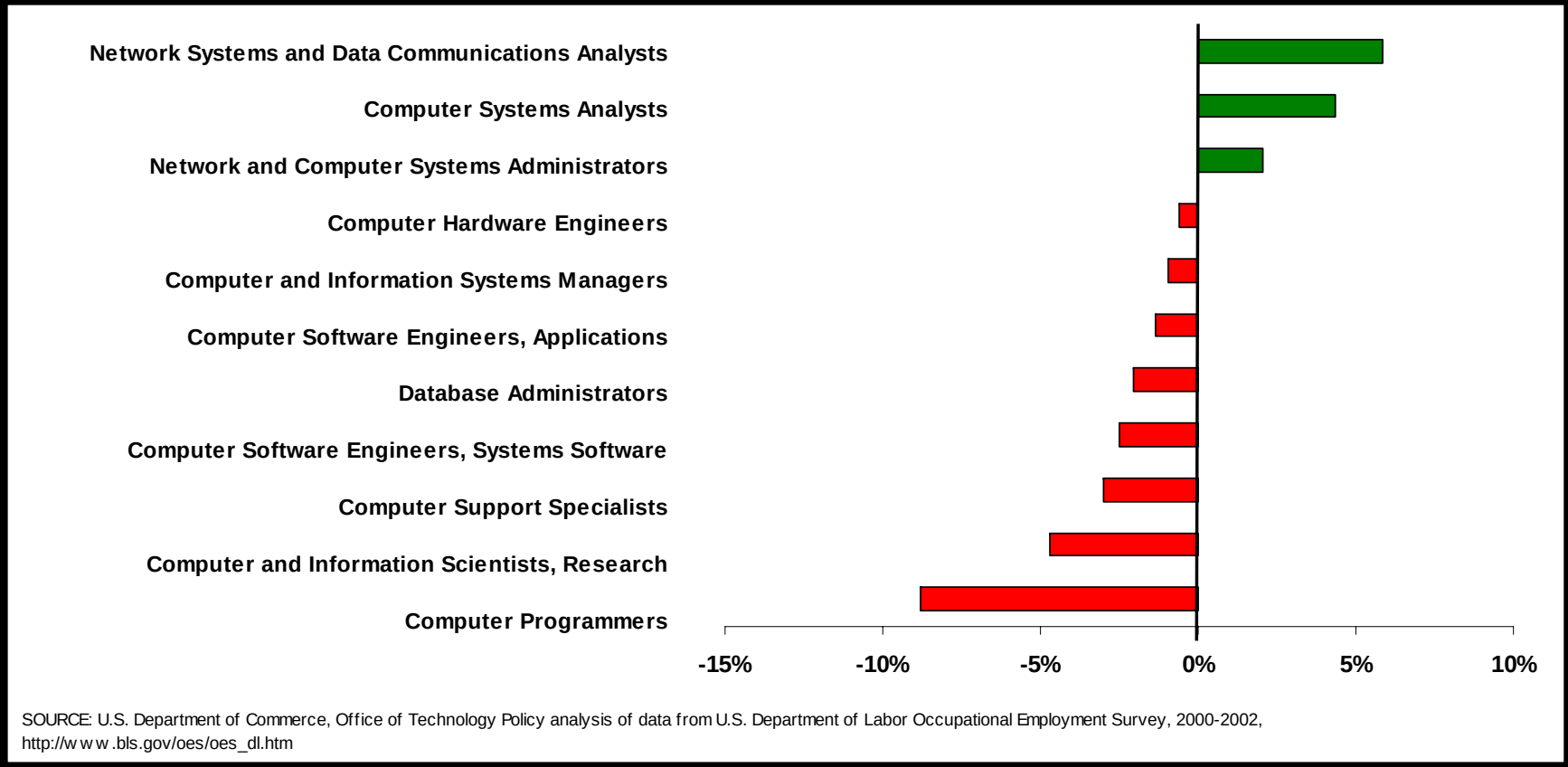
SOURCE: U.S. Department of Commerce, Office of Technology Policy analysis of data from U.S. Department of Labor Occupational Employment Survey data, 2000-2002, http://www.bls.gov/oes/oes_dl.htm

Change in IT Occupational Employment Number, 2001-2002



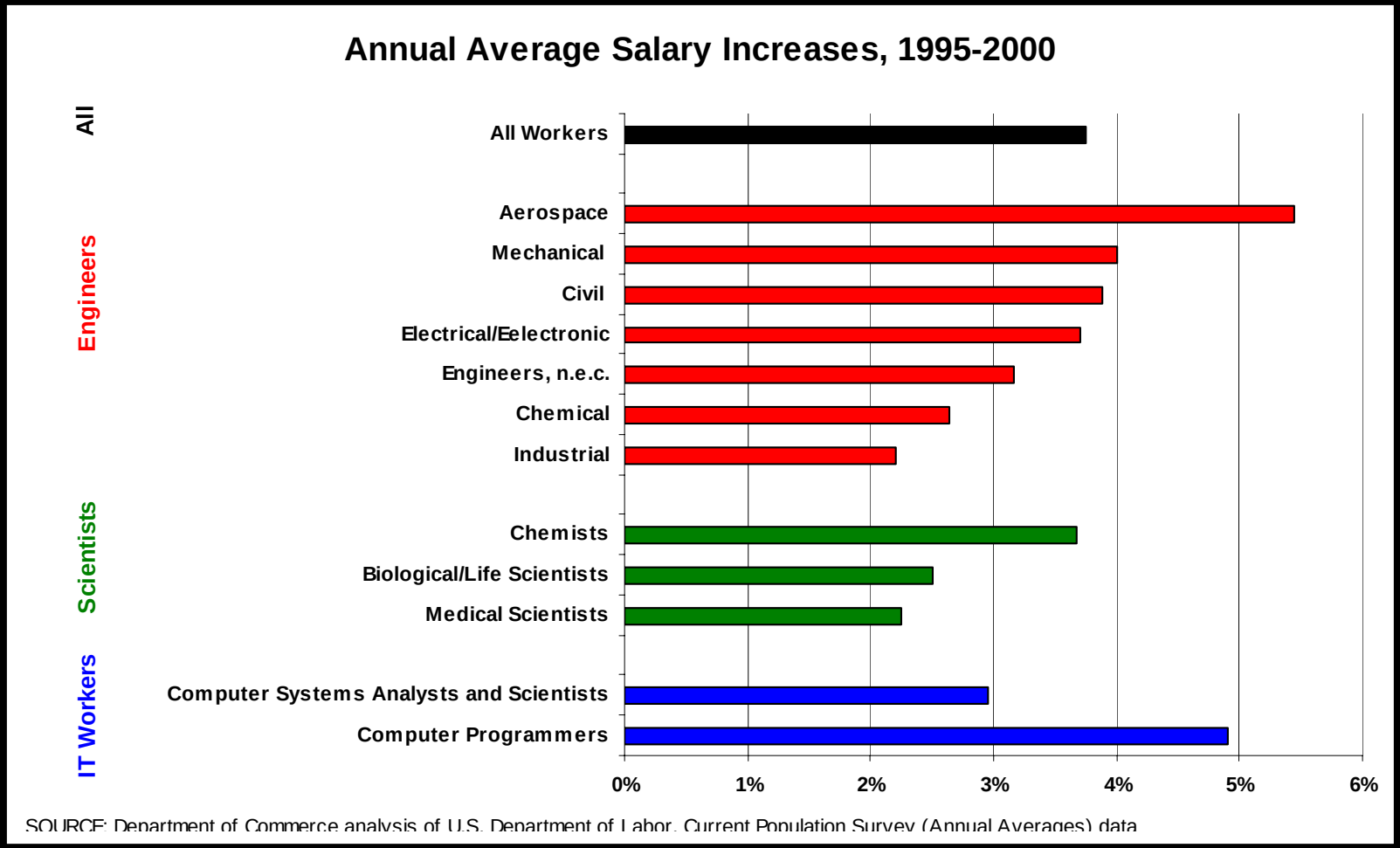
SOURCE: U.S. Department of Commerce, Office of Technology Policy analysis of data from U.S. Department of Labor Occupational Employment Survey, 2000-2002, http://www.bls.gov/oes/oes_dl.htm

Change in IT Occupational Employment
Percentage, 2001-2002

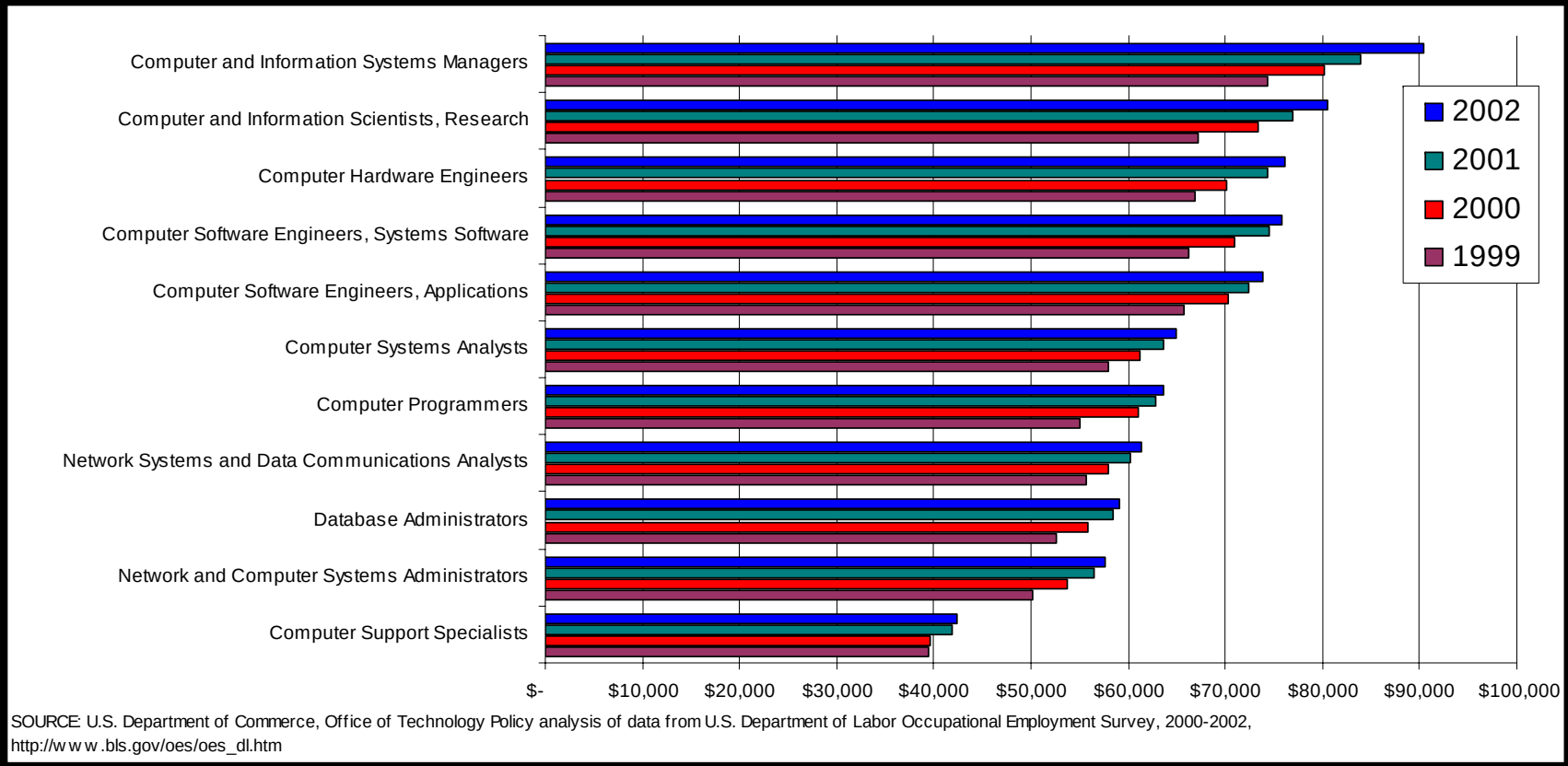


SOURCE: U.S. Department of Commerce, Office of Technology Policy analysis of data from U.S. Department of Labor Occupational Employment Survey, 2000-2002, http://www.bls.gov/oes/oes_dl.htm

Salary Growth

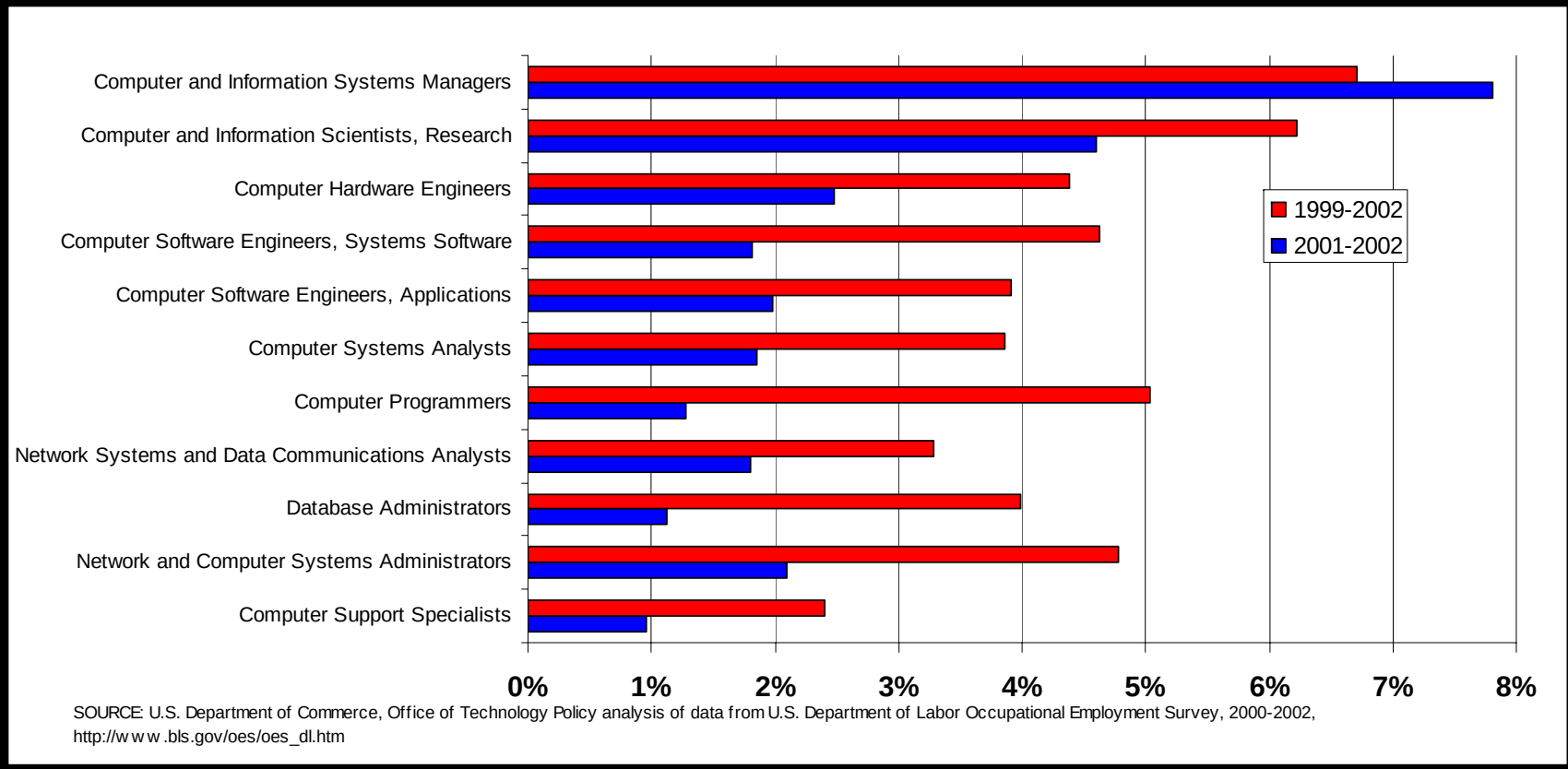


Salary Growth in IT Occupations
1999-2002



SOURCE: U.S. Department of Commerce, Office of Technology Policy analysis of data from U.S. Department of Labor Occupational Employment Survey, 2000-2002, http://www.bls.gov/oes/oes_dl.htm

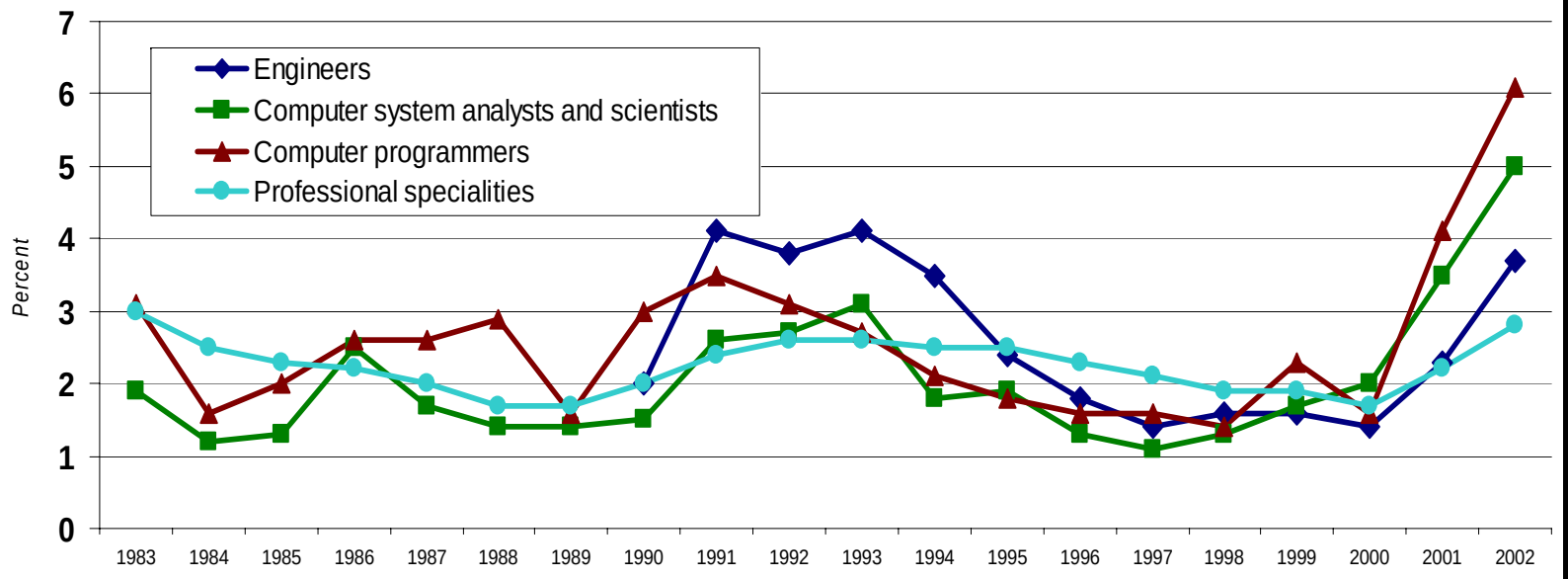
Percent Salary Growth in IT Occupations 1999-2002, 2001-2002



SOURCE: U.S. Department of Commerce, Office of Technology Policy analysis of data from U.S. Department of Labor Occupational Employment Survey, 2000-2002, http://www.bls.gov/oes/oes_dl.htm

Unemployment Rates

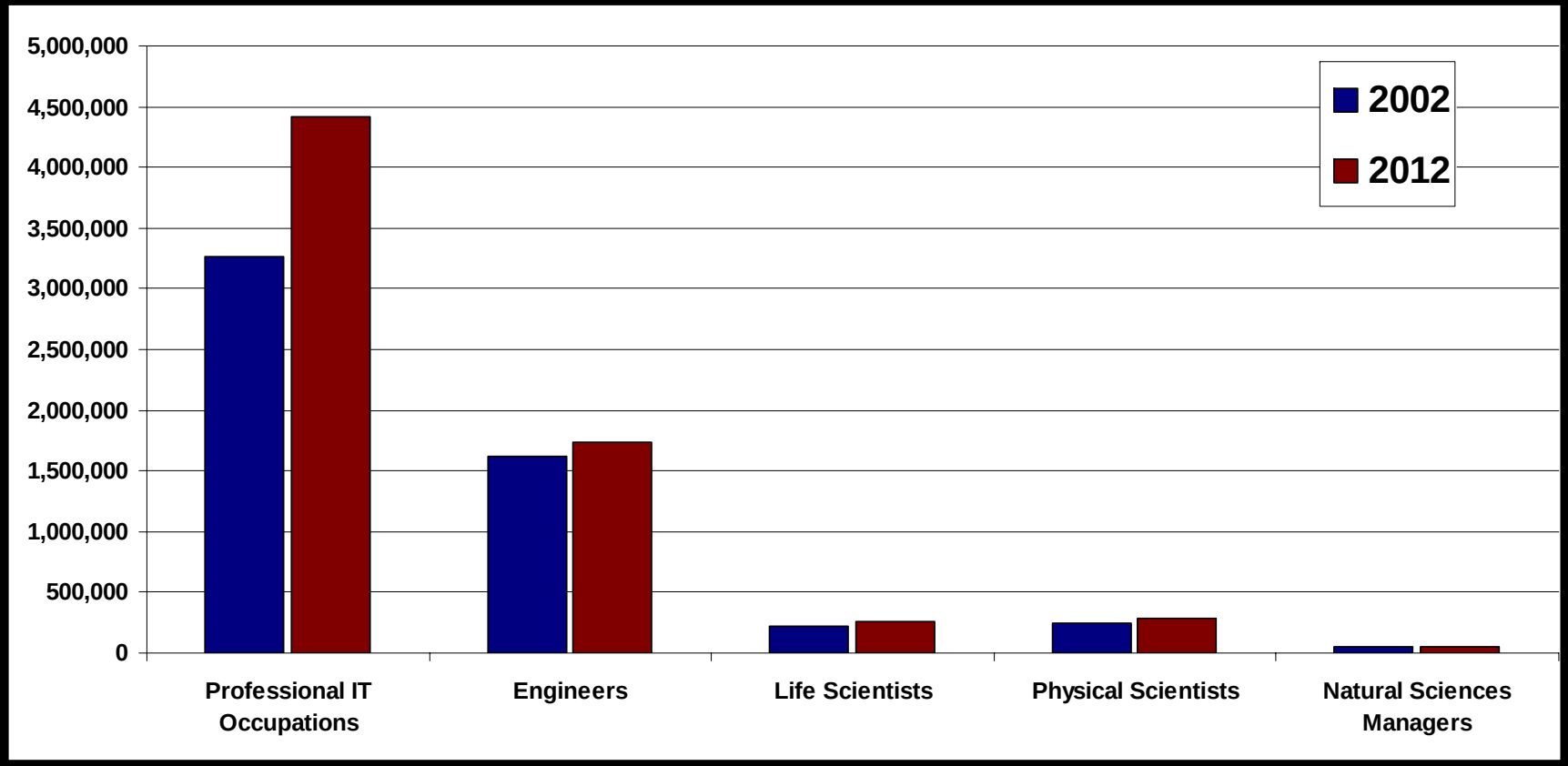
Average Annual Unemployment
Engineers, IT Workers, Professional Specialties
1983-2002



NOTE: The labor force and unemployed reported above include only the experienced unemployed, classified by the occupation of their last job. Computer system analysts and scientists includes computer analyst, computer scientist, computer-systems planning, computer-systems analyst, data processing consultant, information scientist, softw are specialist, and other occupations. Computer system analysts and scientists are classified w ithin professional specialty occupations and computer programmers in technicians and related support occupations. Data for 2000-2002 have been revised to incorporate population controls from Census 2000.

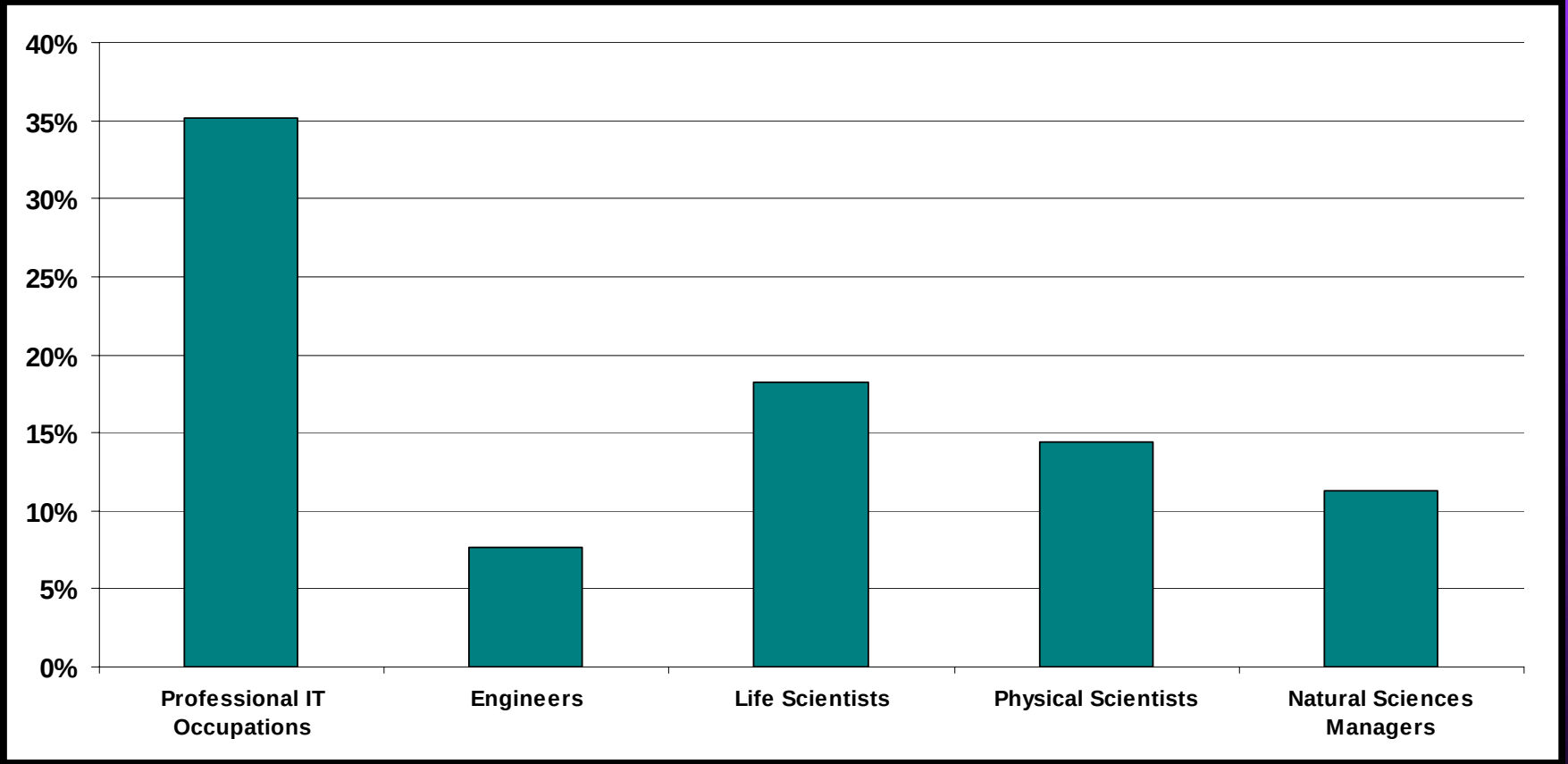
IT, Science and Engineering Occupational Projections, 2002-2012

Employment, Numbers



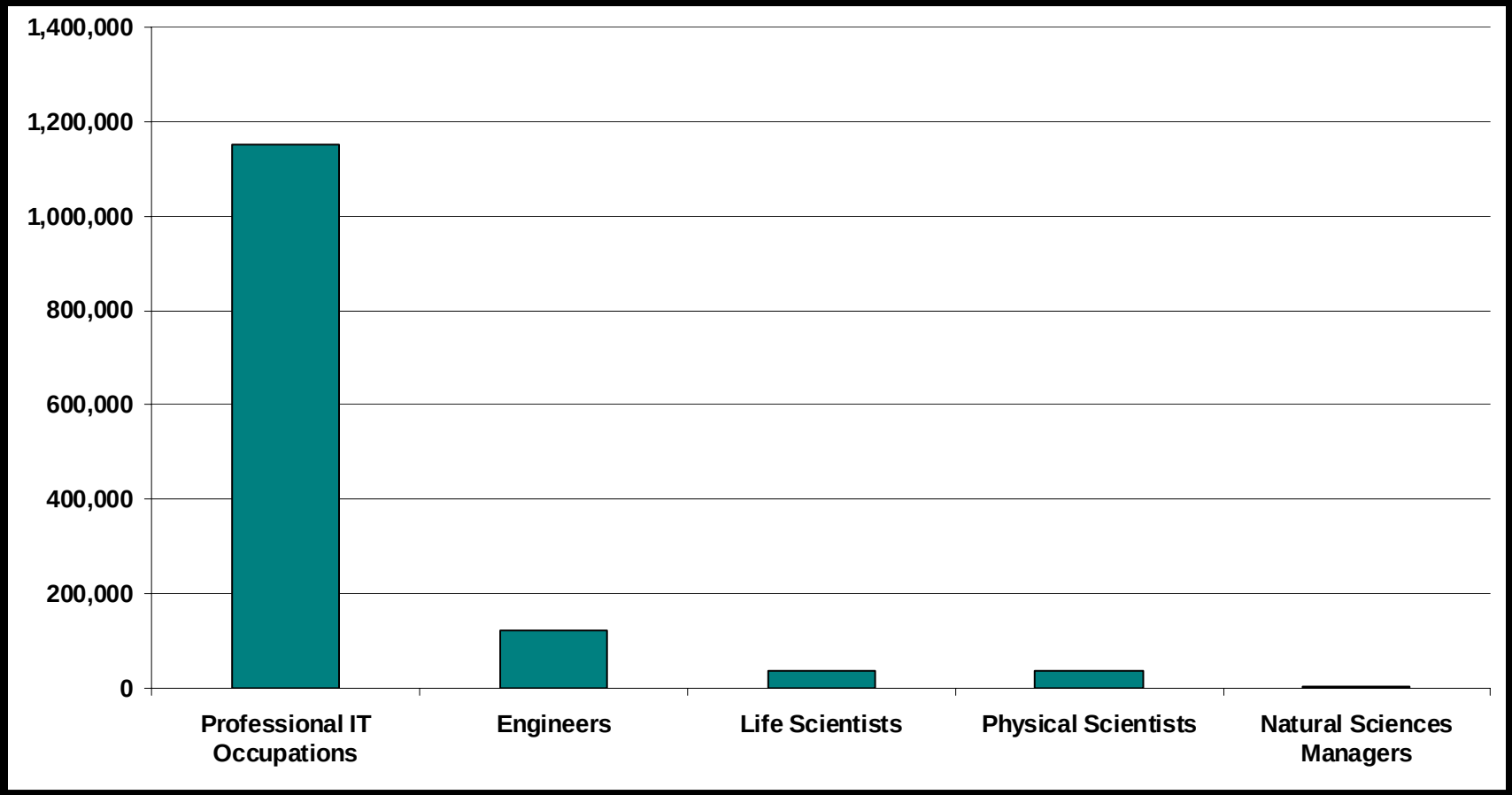
IT, Science and Engineering Occupational Projections, 2002-2012

Employment Growth: Rate



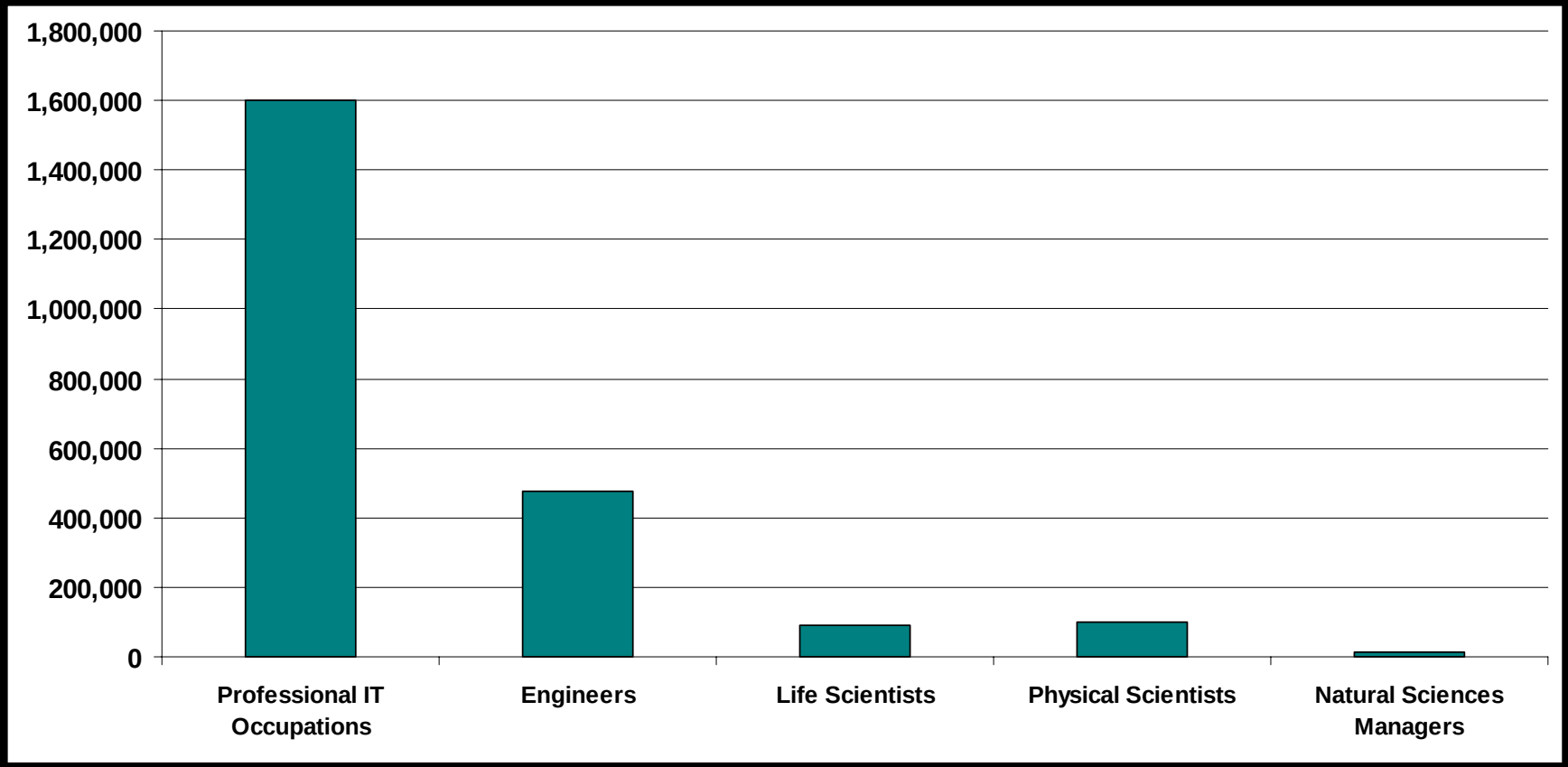
IT, Science and Engineering Occupational Projections, 2002-2012

Employment Growth: Numbers

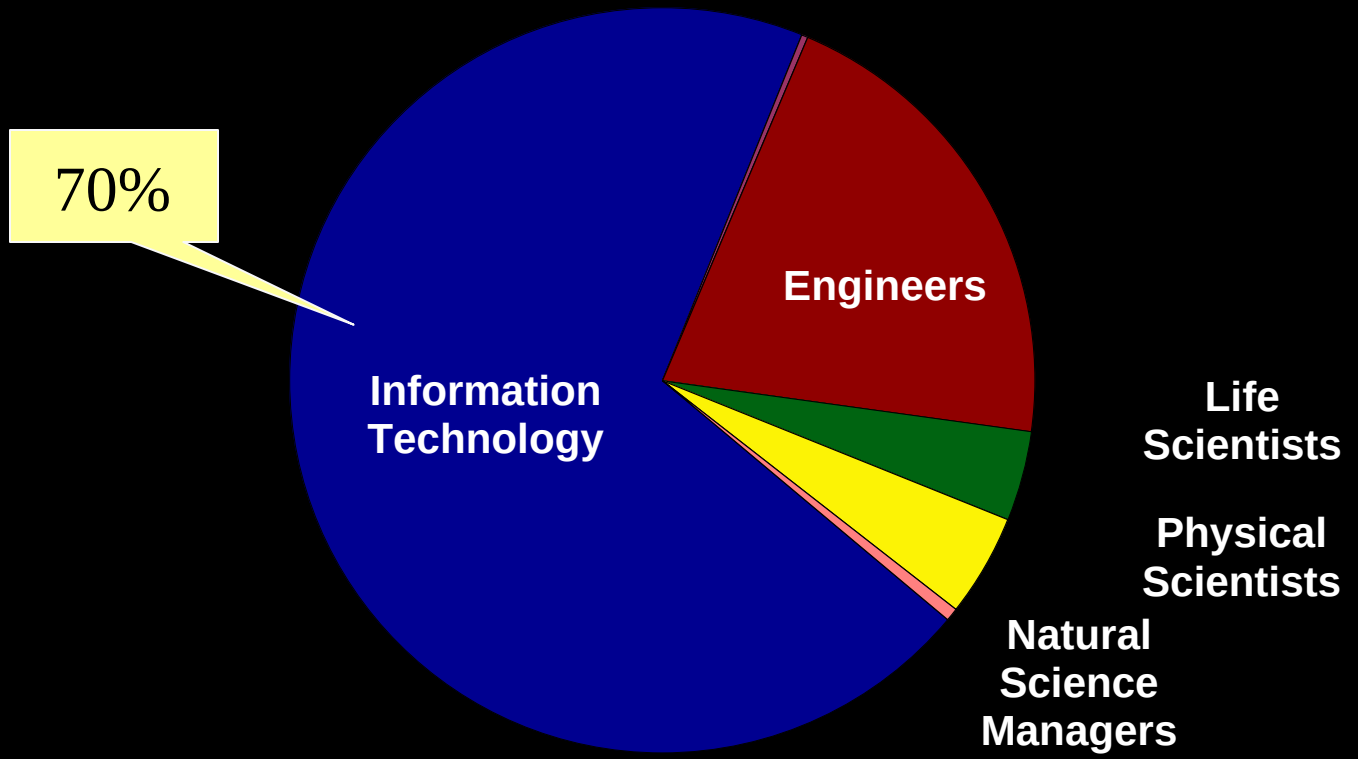


IT, Science and Engineering Occupational Projections, 2002-2012

Total Job Openings

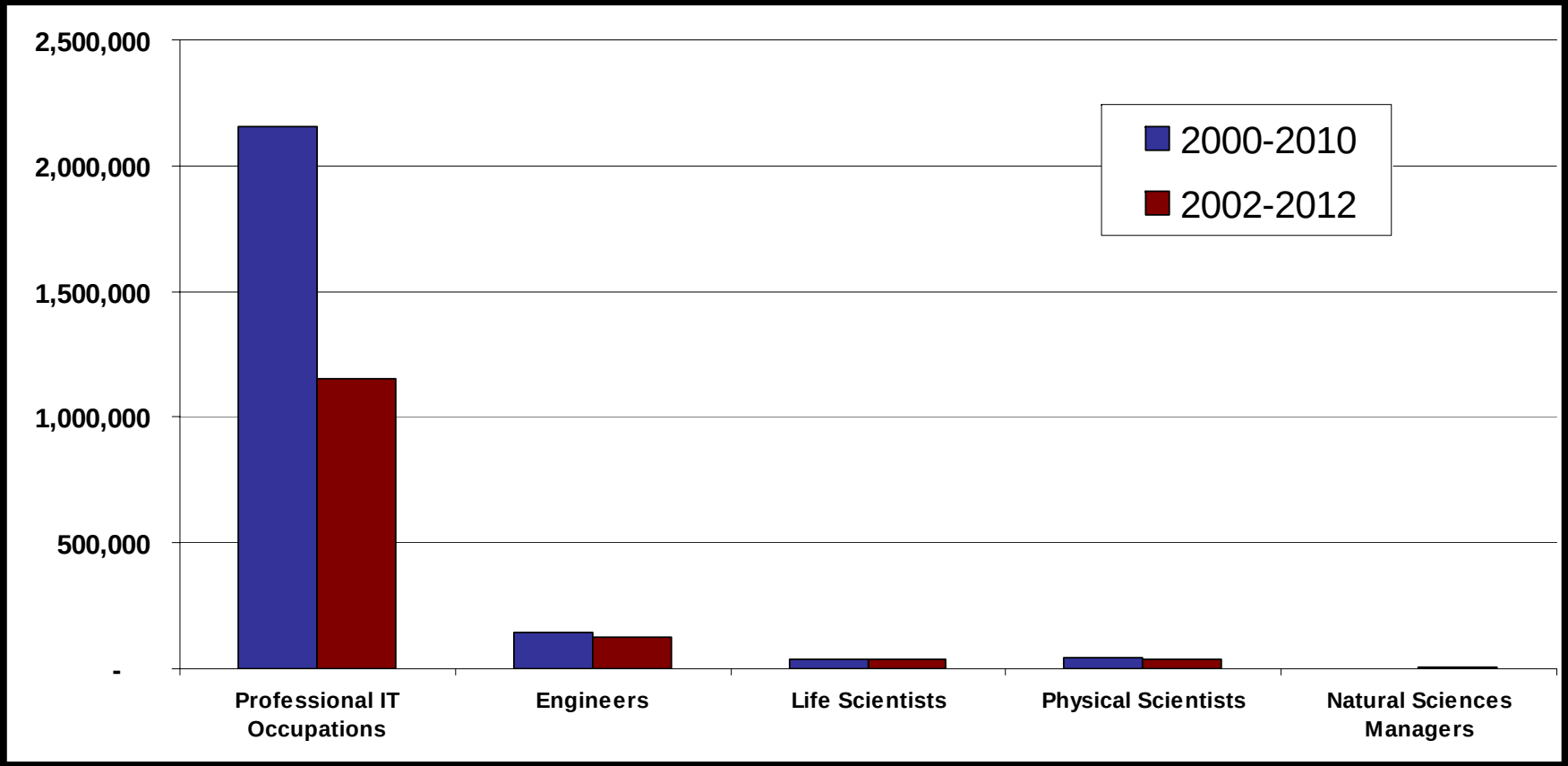


Occupational Distribution of Projected S&E Job Openings
(new jobs plus net replacements) 2002-2012



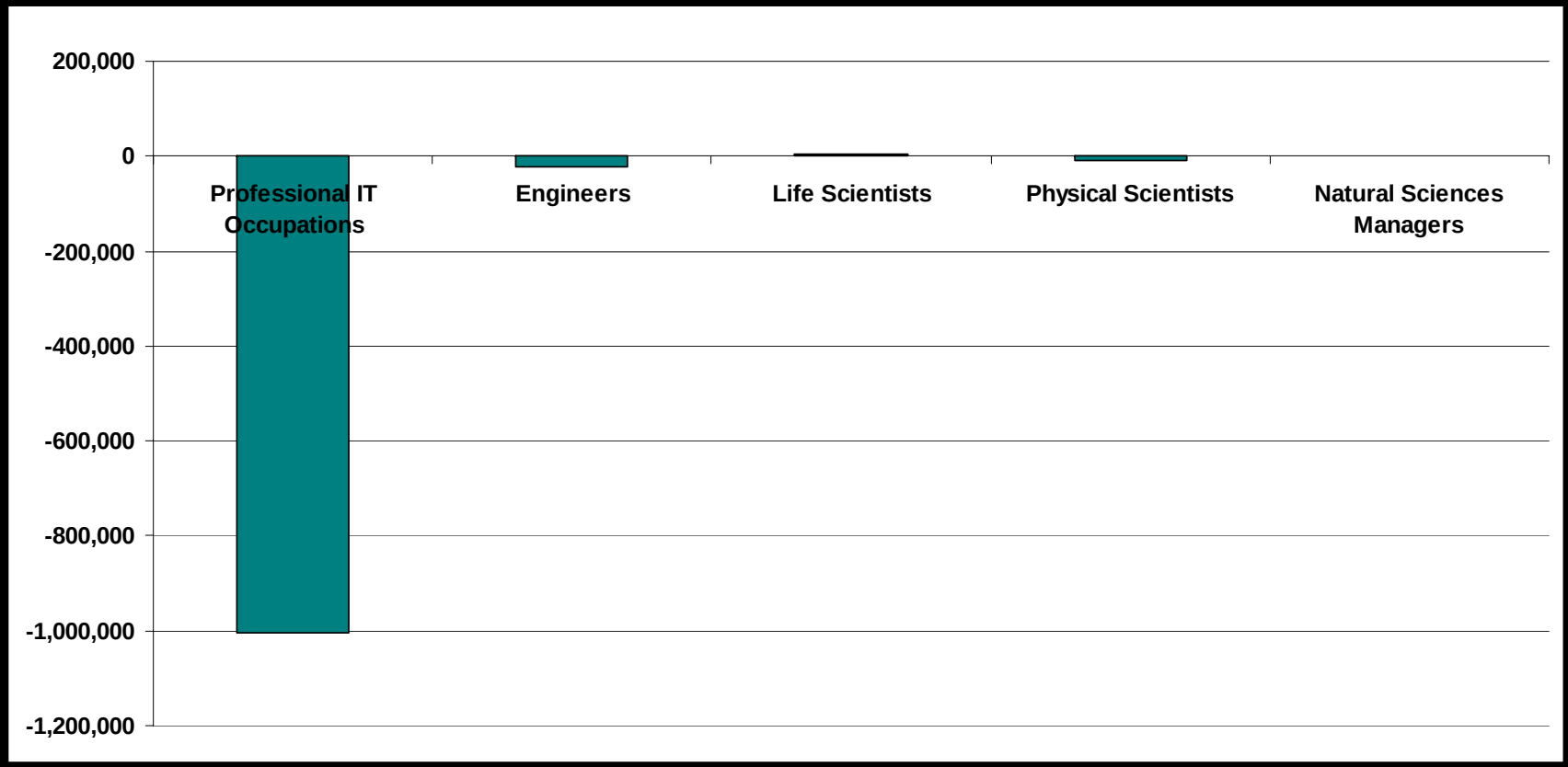
IT, Science and Engineering Occupational Projections, 2002-2012

Job Growth: 2000-2010 vs. 2002-2012



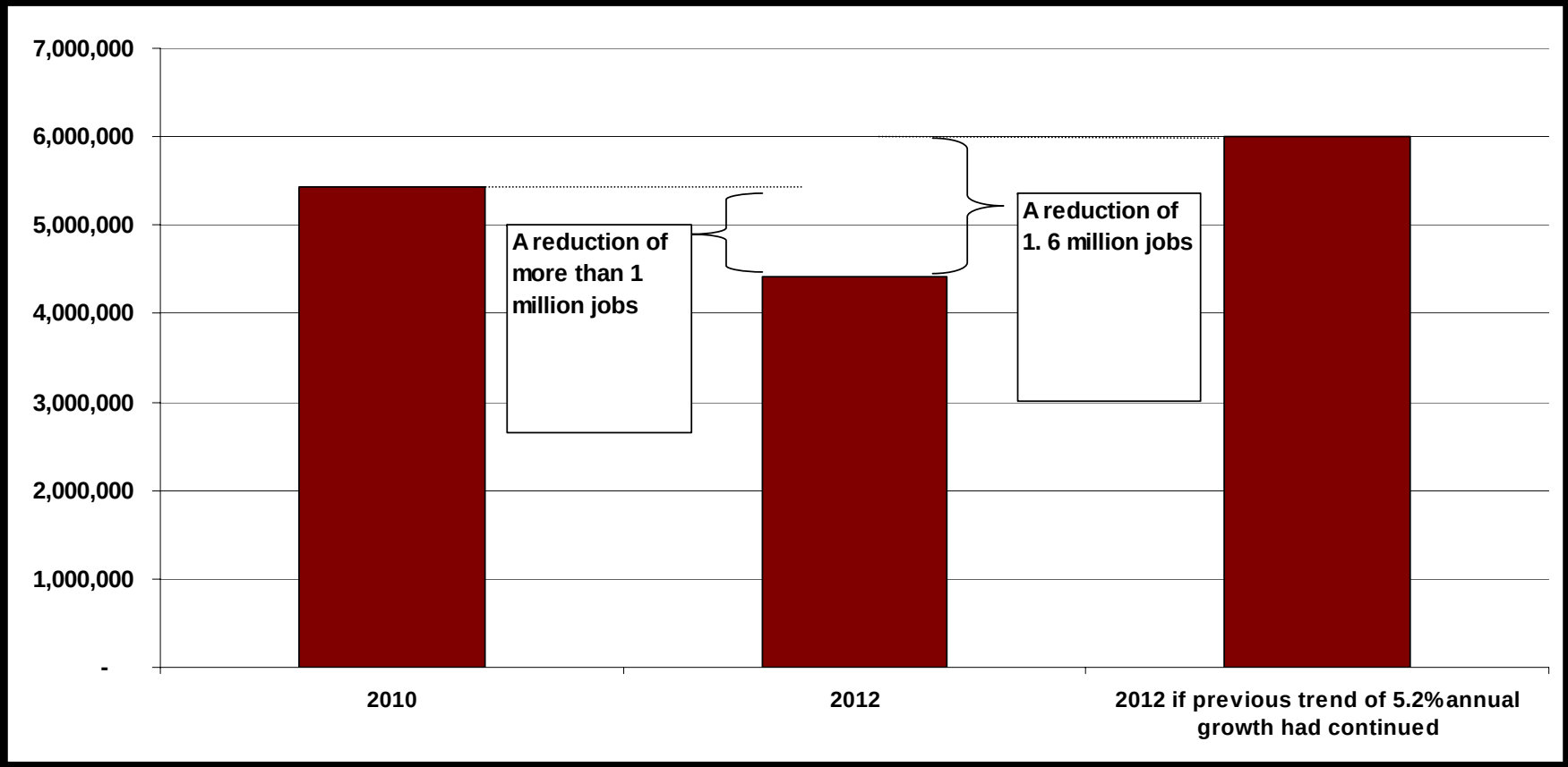
IT, Science and Engineering Occupational Projections, 2002-2012

Change in Growth: 2000-2010 vs. 2002-2012



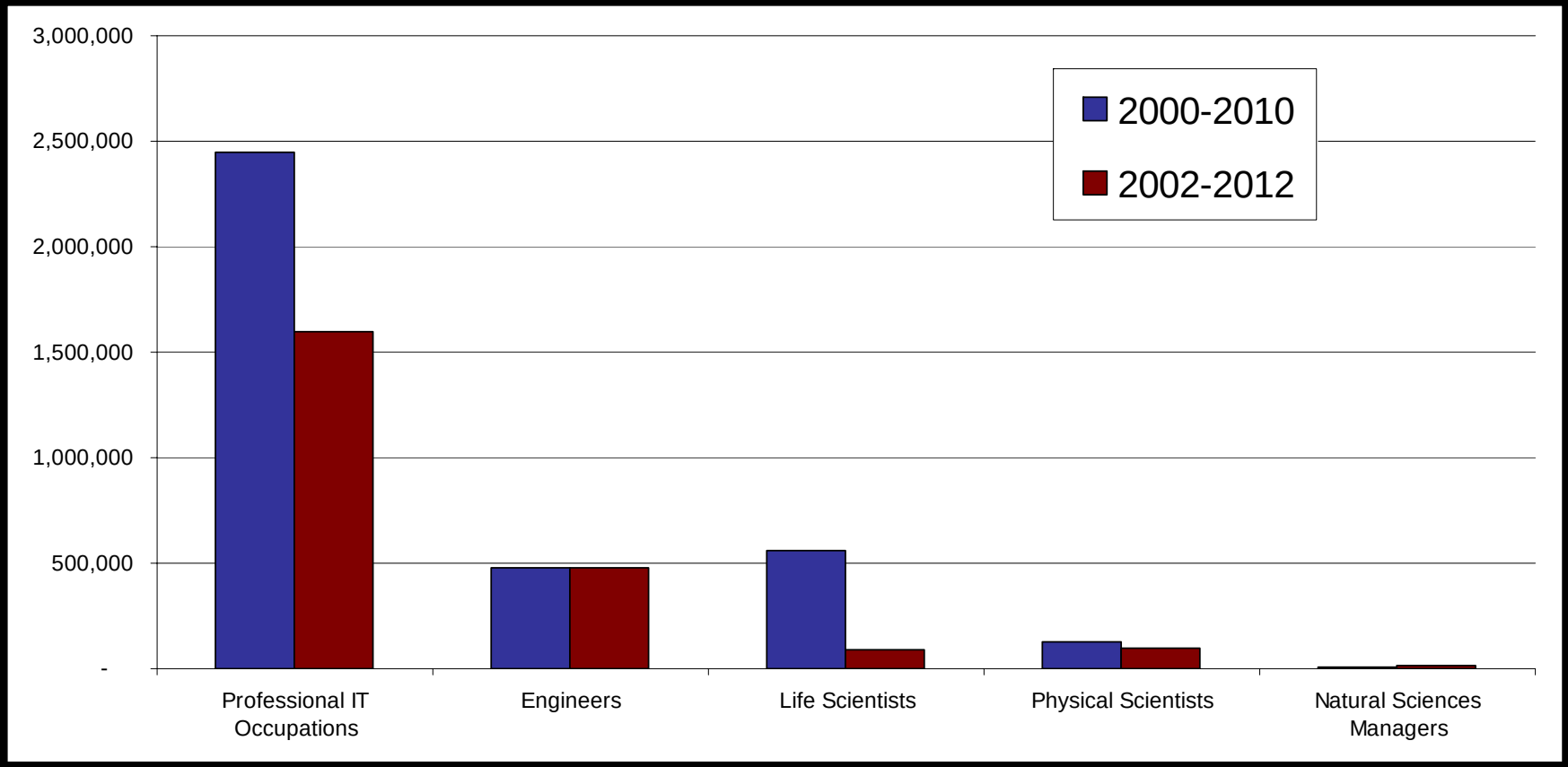
IT, Science and Engineering Occupational Projections, 2002-2012

Projected IT Job Growth 2010 vs. 2012 Projections



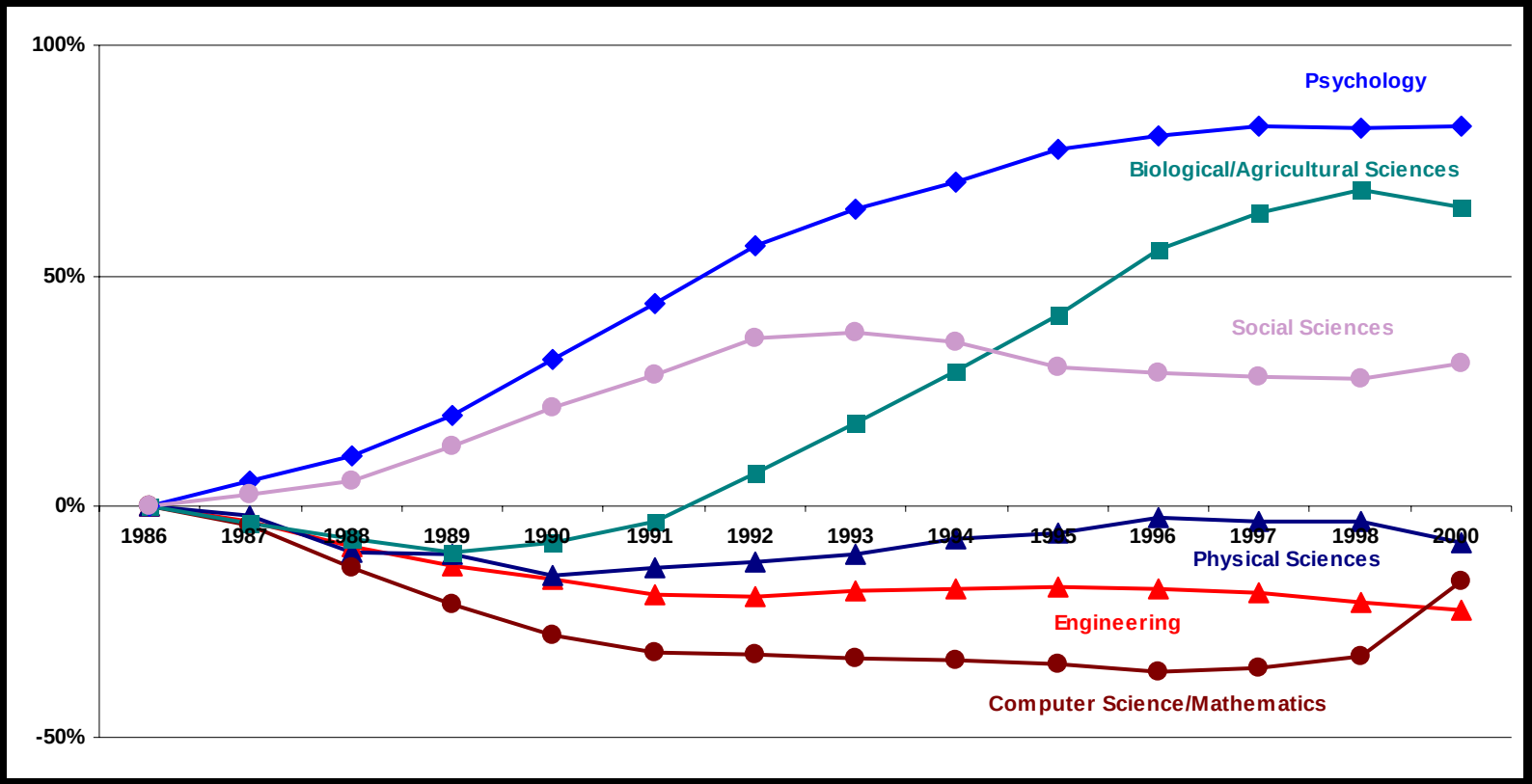
IT, Science and Engineering Occupational Projections, 2002-2012

Change in Total Openings: 2000-2010 vs. 2002-2012



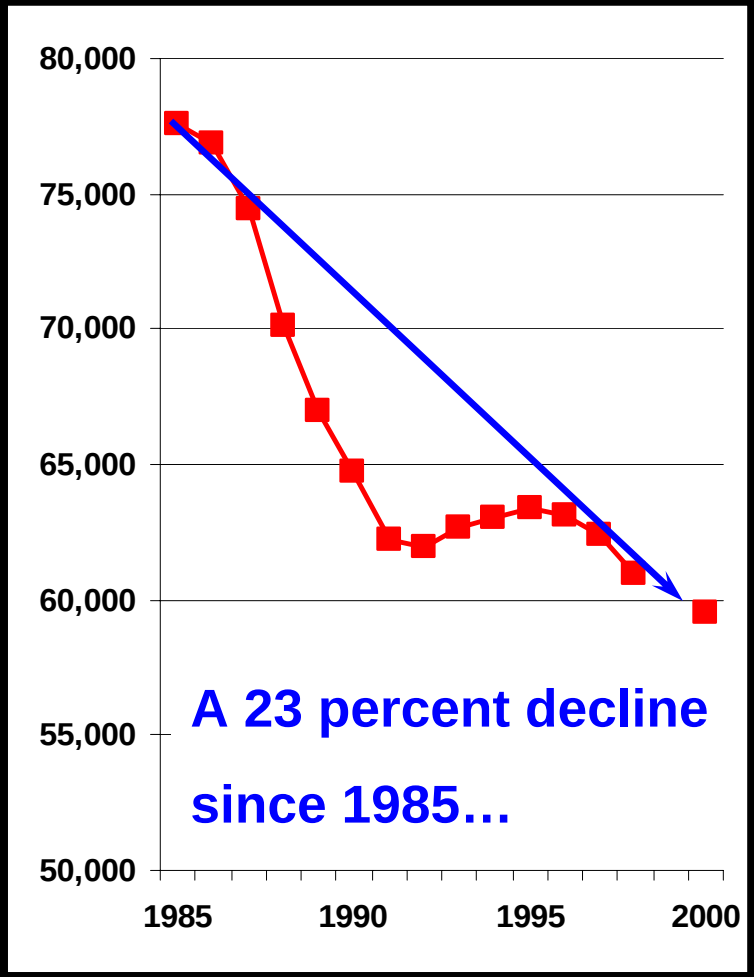
S&E Bachelor's Degrees

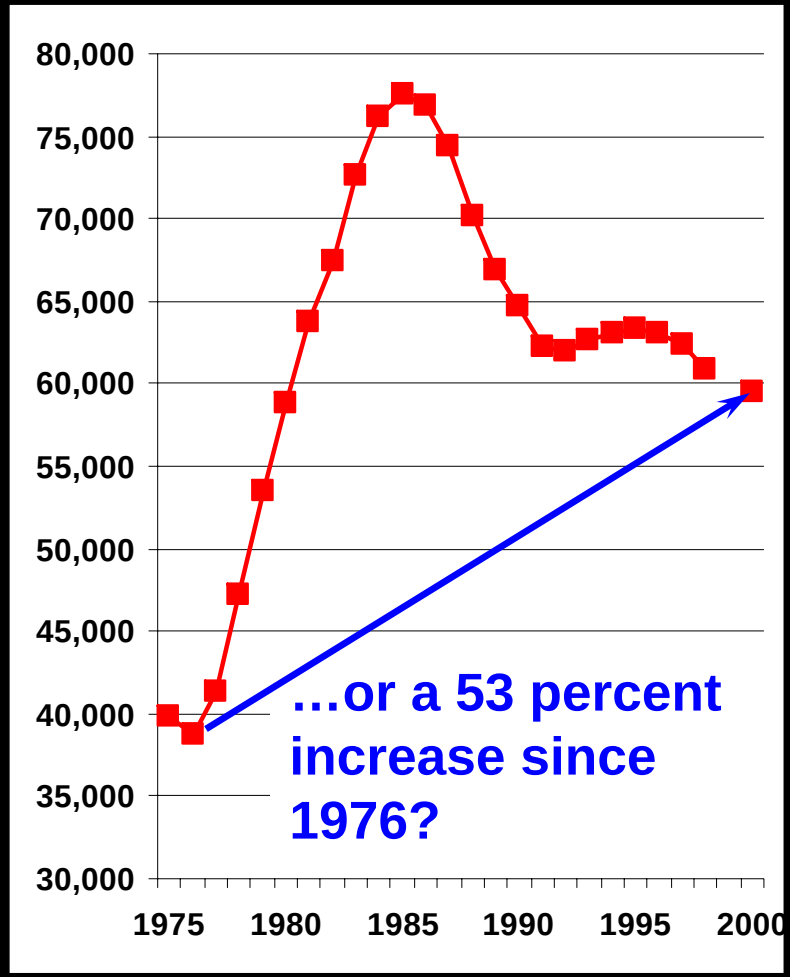
Life Sciences Up...



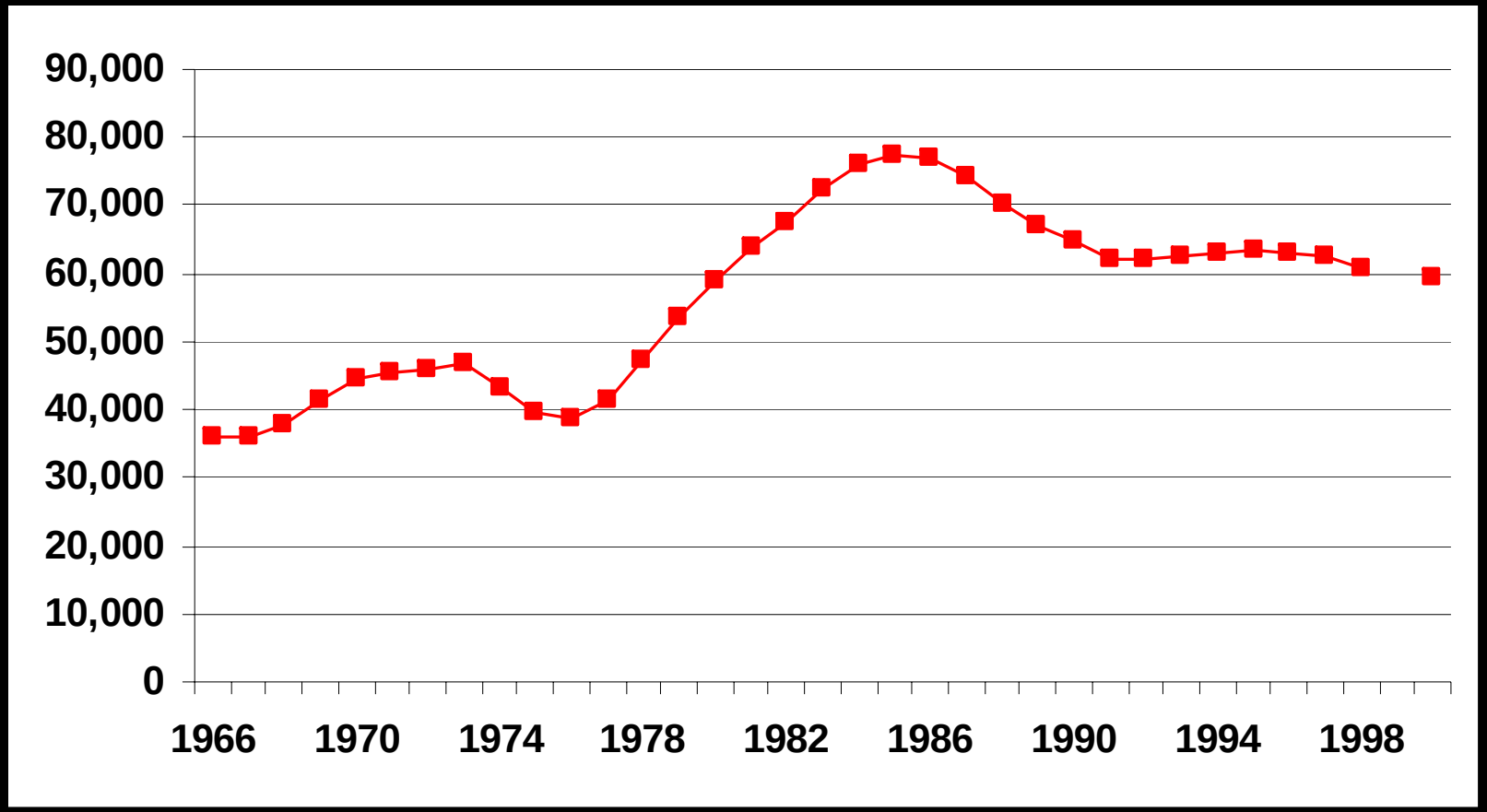
...Engineering, Physical Sciences, and Math Down

Engineering Bachelor's Degrees… Half Empty or Half Full?



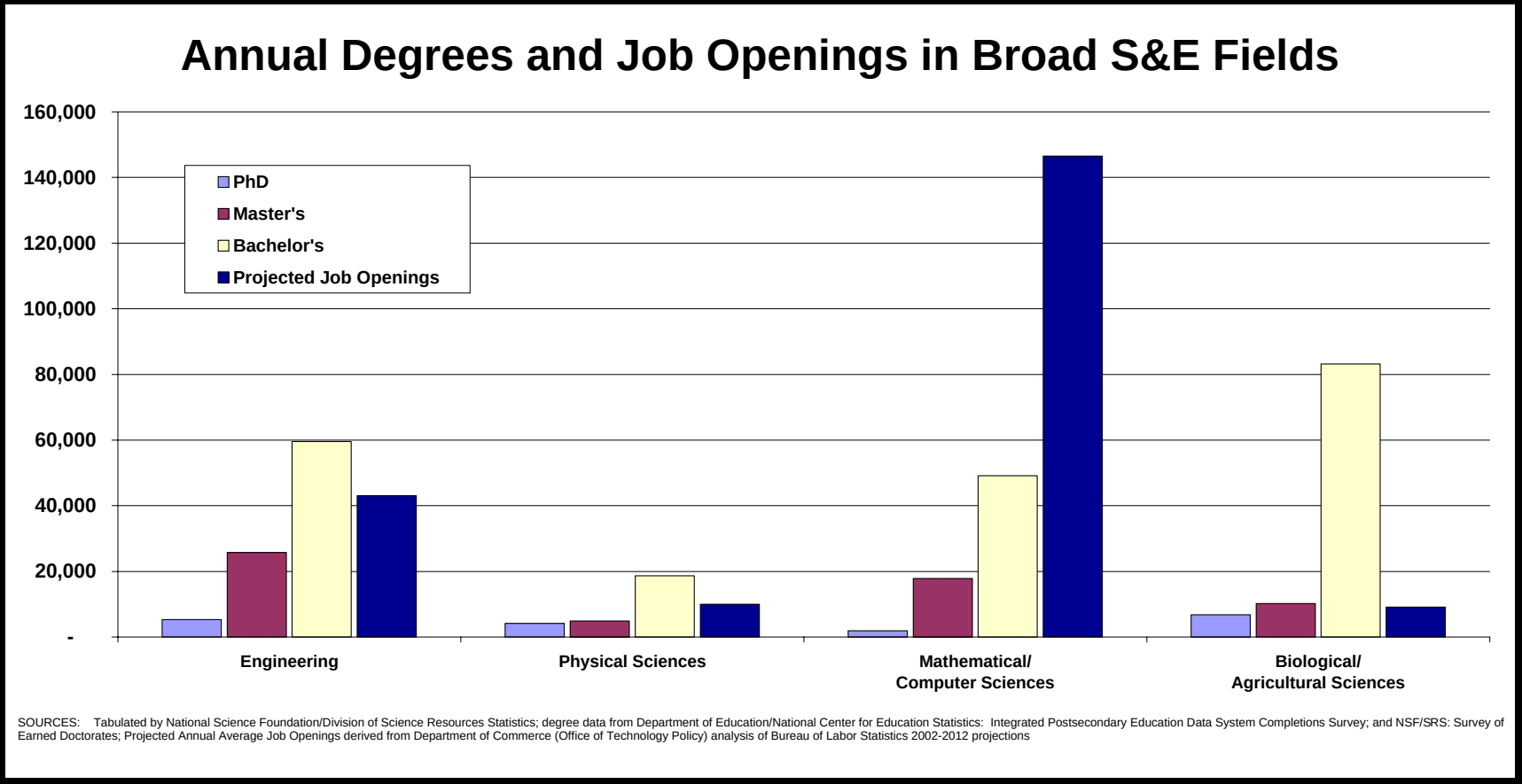


Both, depending on your perspective...



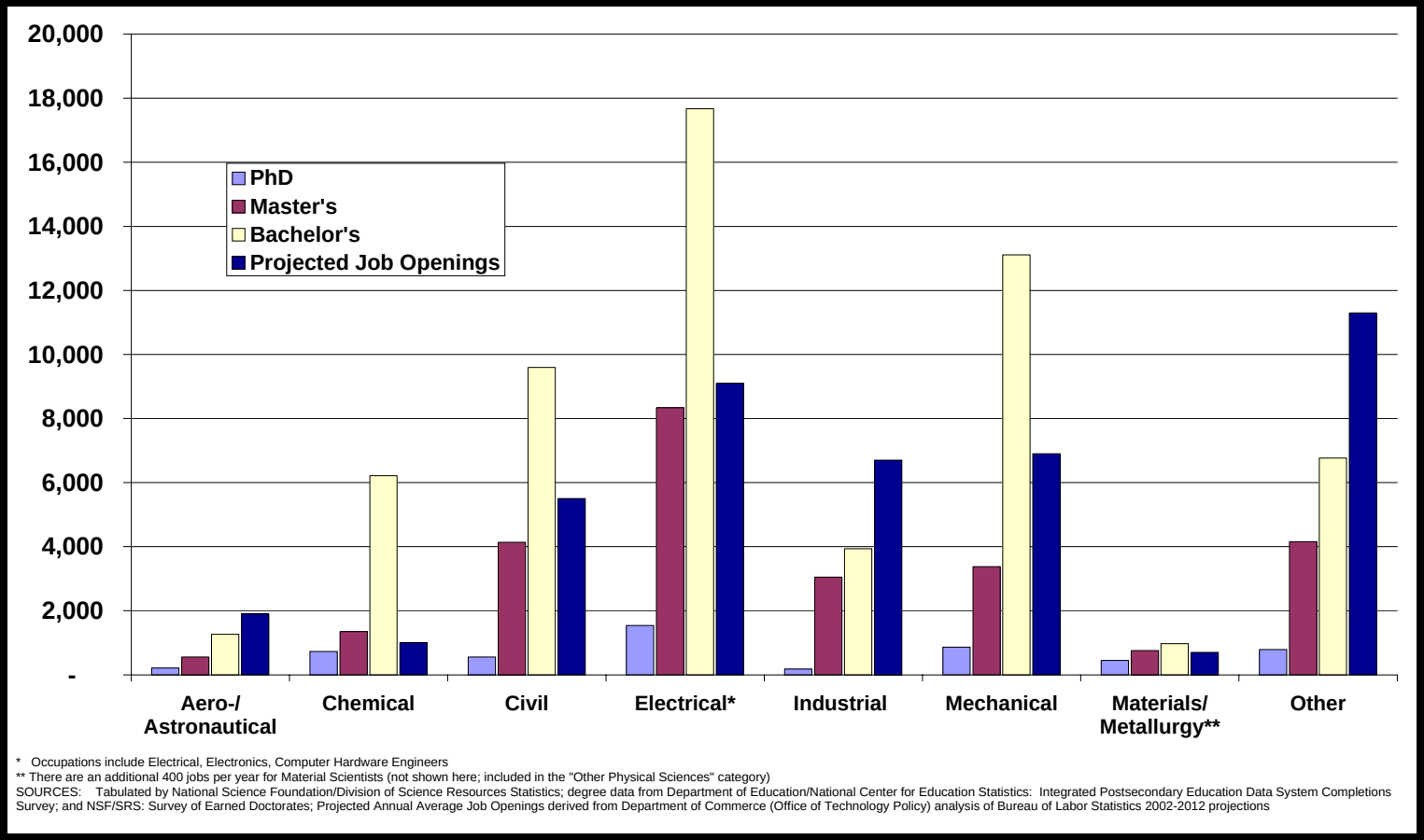
The Market Perspective

Degree Production vs. Projected Job Openings



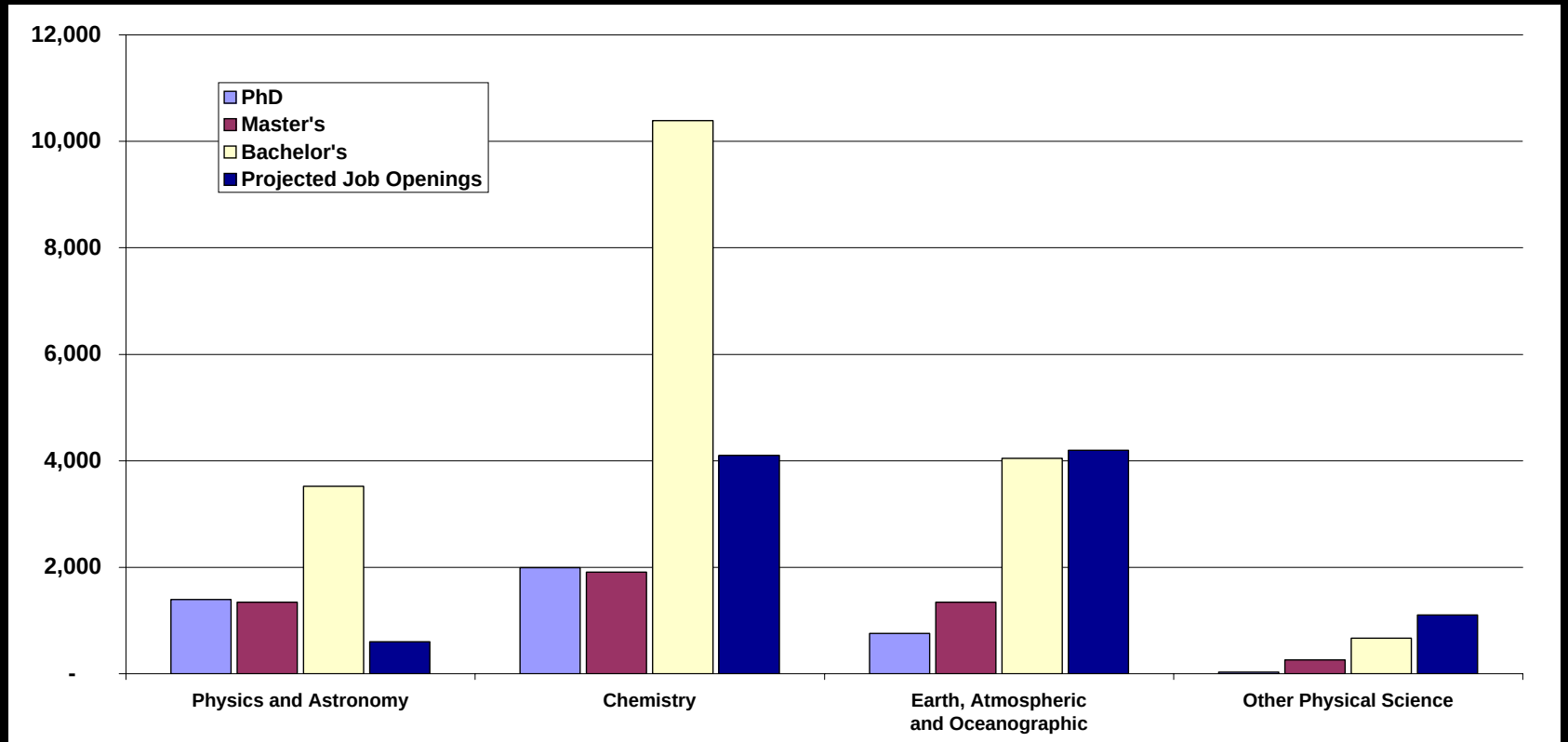
SOURCES: Tabulated by National Science Foundation/Division of Science Resources Statistics; degree data from Department of Education/National Center for Education Statistics: Integrated Postsecondary Education Data System Completions Survey; and NSF/SRS: Survey of Earned Doctorates; Projected Annual Average Job Openings derived from Department of Commerce (Office of Technology Policy) analysis of Bureau of Labor Statistics 2002-2012 projections

Engineering
Degrees & Projected Job Openings



* Occupations include Electrical, Electronics, Computer Hardware Engineers
** There are an additional 400 jobs per year for Material Scientists (not shown here; included in the "Other Physical Sciences" category)
SOURCES: Tabulated by National Science Foundation/Division of Science Resources Statistics; degree data from Department of Education/National Center for Education Statistics: Integrated Postsecondary Education Data System Completions Survey; and NSF/SRS: Survey of Earned Doctorates; Projected Annual Average Job Openings derived from Department of Commerce (Office of Technology Policy) analysis of Bureau of Labor Statistics 2002-2012 projections

Physical Sciences
Degrees & Projected Job Openings



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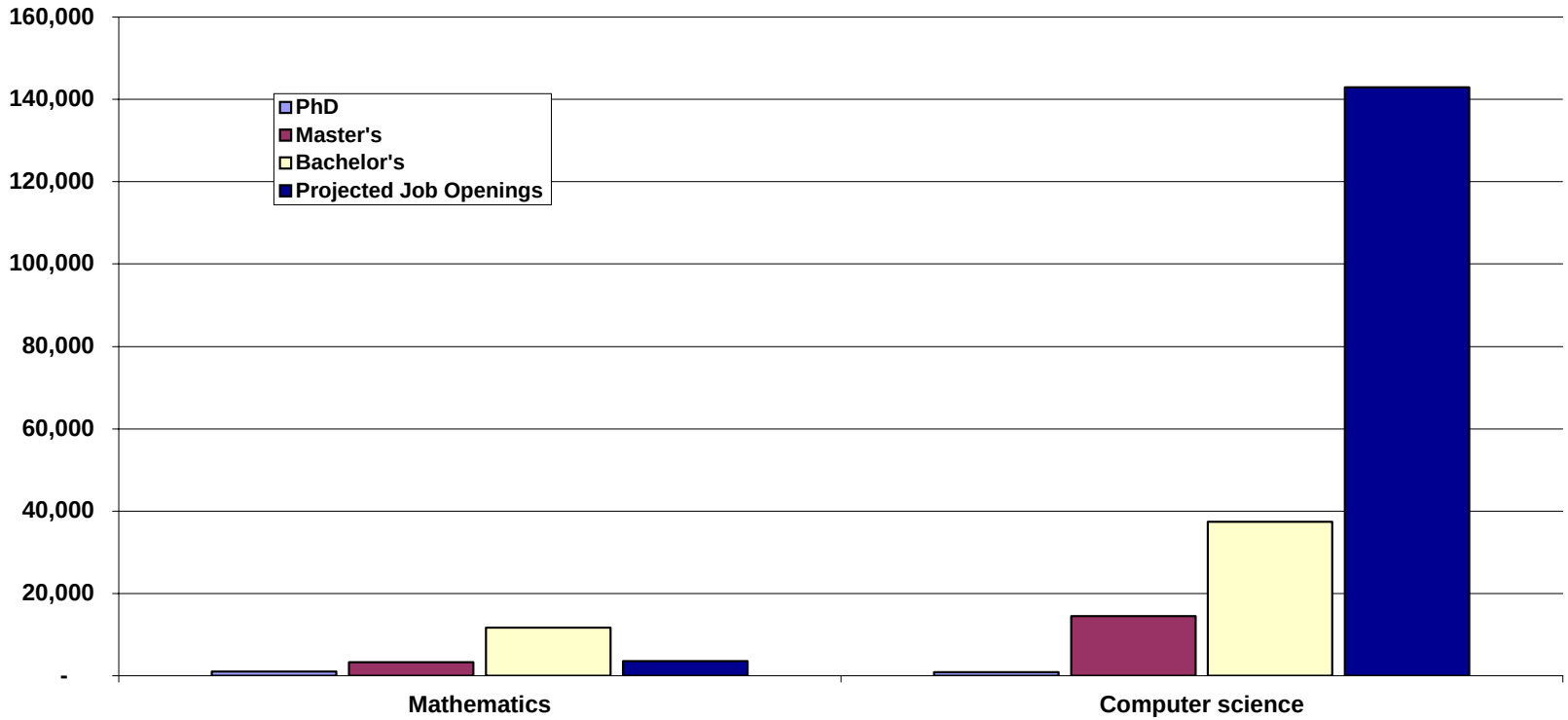
Mathematics and Computer Science
Degrees & Projected Job Openings



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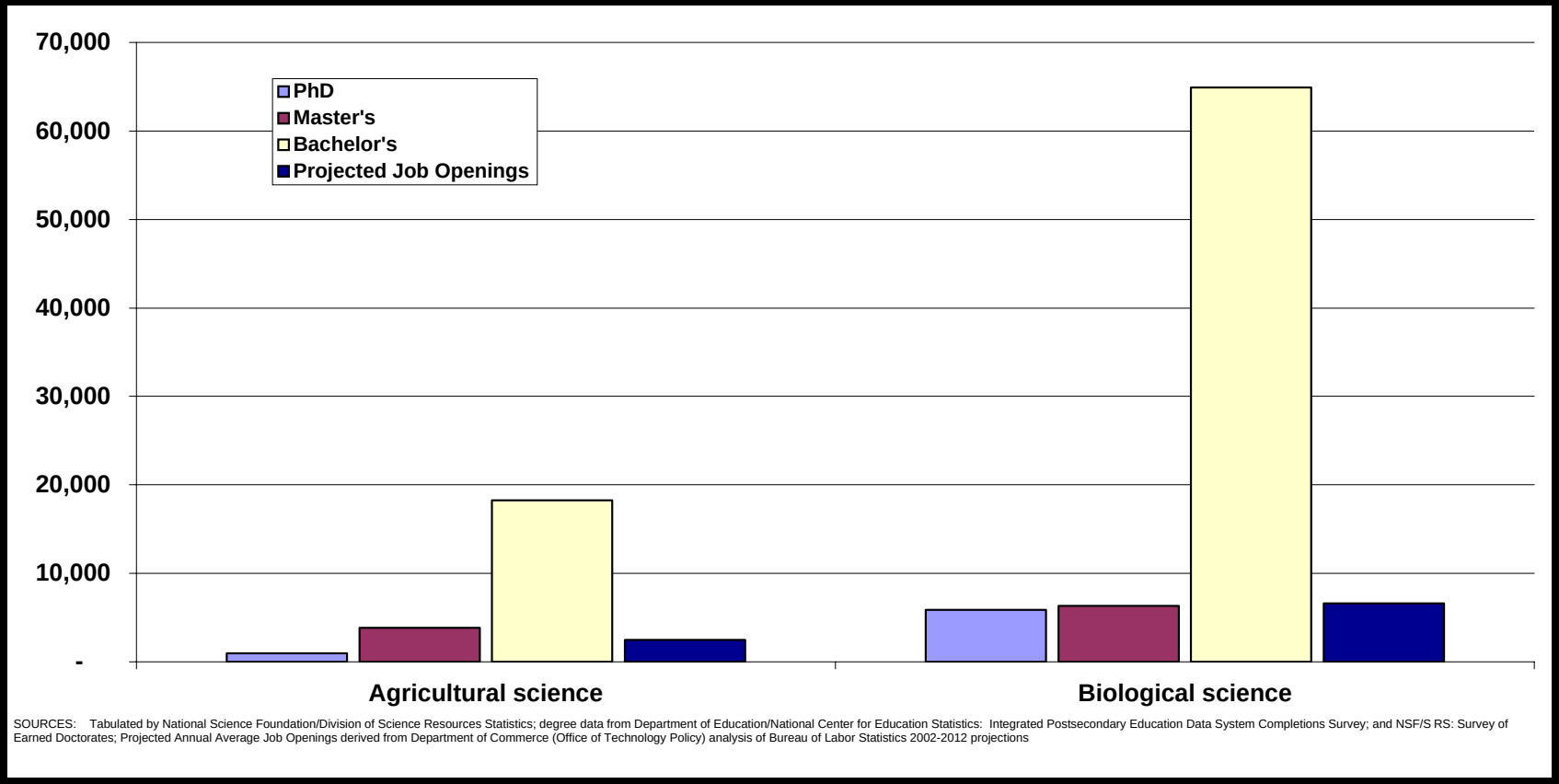
Biological and Agricultural Sciences
Degrees & Projected Job Openings



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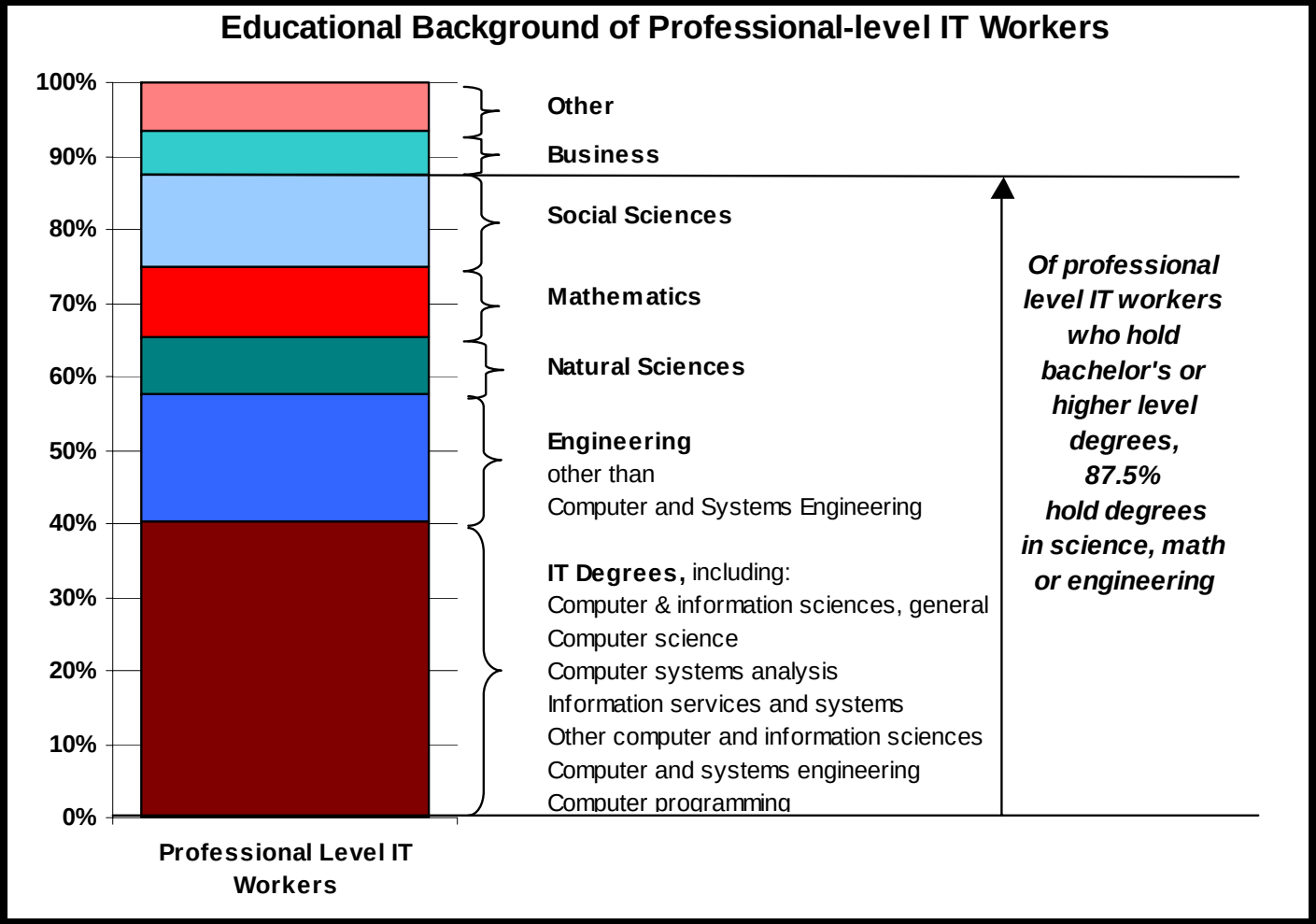
IT Education & Training Landscape

How IT Workers Get and Maintain their Skills

- IT Bachelor's Degrees
- IT-Related Minors
- Combined IT Bachelors/Masters Degree Programs
- IT-Related Masters of Science Programs
- Techno MBAs
- Two-Year IT Degrees at Community Colleges
- IT Certificate Programs
- Private, For-Profit Education and Training Institutions
- Vendor and Vendor-neutral IT Certification
- Federal, State and Regional IT Training Initiatives
- Boot Camps and Seminars
- Employer Programs
- On-Line, CD-ROM, Books
- The Churn

Professional Level IT Workers Hold a Wide Array of Science, Engineering and Other Degrees



Possible Niche Areas of Need

- Emerging Disciplines
- Converging Disciplines
- Industries Affected by Past/Current Federal Demand
- University Professors in High Demand Disciplines
- Federal S&E Employees: Unique Challenges
- Industries with Past Workforce Shocks

Challenge to the Community: Action

- Amplify Market Signals
  - Industry Feedback to Post-Secondary Institutions
  - Post-Secondary Institutions' Responsiveness to Market Demands
    - Preparation for industry careers
    - Technical skills in demand
    - Soft and business skills
  - Career Awareness in Middle, High School
  - Dissemination of Occupational Data
    - Demand, job characteristics, unemployment, etc.
- Improve Math and Science Education in K-12

Challenge to the Community: Action

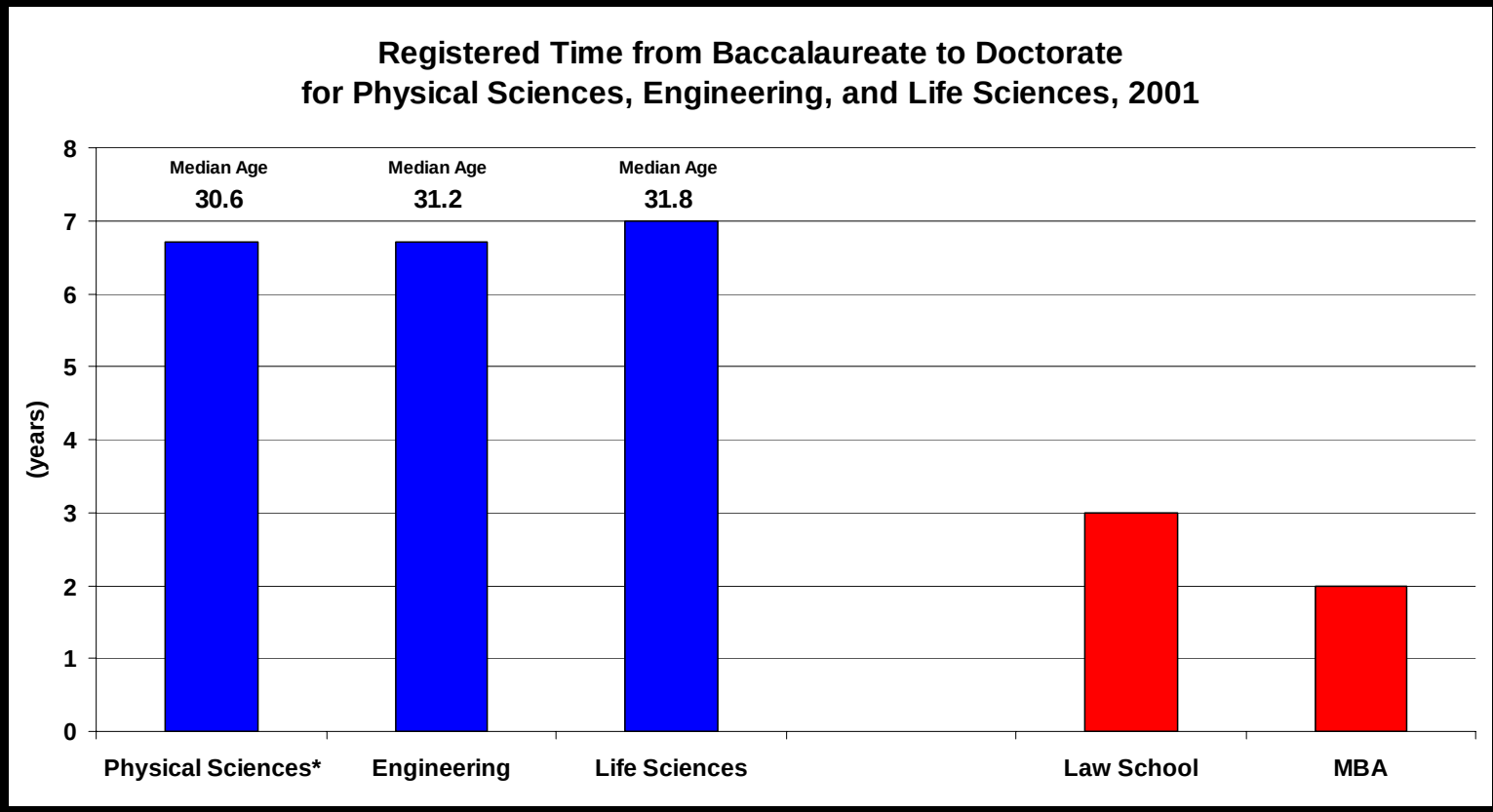
- Math and Science Education in K-12
- Image of Scientists and Engineers
- S&E Career Awareness in Middle, High School
- Industry Feedback to Post-Secondary Institutions
- Post-Secondary Institutions' Responsiveness to Market Demands
- Industry Must Help Itself

Challenges to Growing Domestic S&E Workforce

- Cost-Benefit of Grad Education in S&E vs. Law, Business

Challenges to Growing Domestic S&E Workforce

- Cost-Benefit of Grad Education in S&E vs. Law, Business



Challenges to Growing Domestic S&E Workforce

- Cost-Benefit of Grad Education in S&E vs. Law, Business
- Attractiveness of Careers in S&E vs. Law, Business
- Strong Emphasis by Other Nations, Cultures on S&E Education
- Access to Foreign Labor in the U.S. (H-1B, L1)
- Access to Foreign Labor Abroad (Offshoring—direct and through contract)
  - Significantly lower salary costs
  - Pools of well-educated S&E talent
  - Improved national infrastructure, political stability
- Large Government, Industry Focus on Health R&D

Factors Supporting U.S. Ability to Grow Domestic S&E Workforce

- Premier Academic Research Institutions
- Elite Students Among Best in World
- Powerful Industrial Base, Potential Partners in S&E Education and Training
- Money Talks!

Contact Information

John F. Sargent

Senior Policy Analyst

Office of Technology Policy, Technology Administration

U.S. Department of Commerce

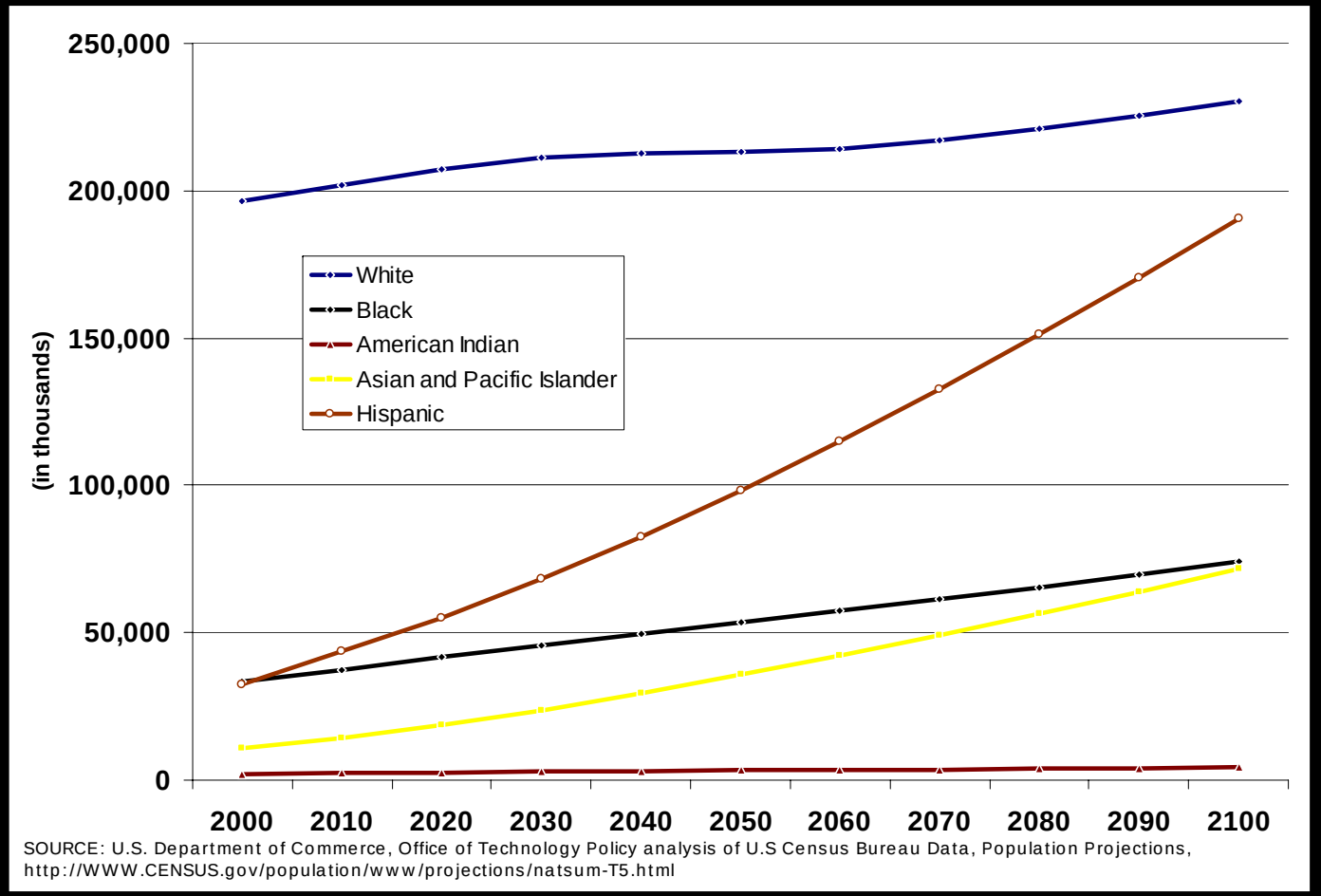
202-482-6185

jsargent@ta.doc.gov

www.ta.doc.gov

Census Bureau Projections Thru 2100

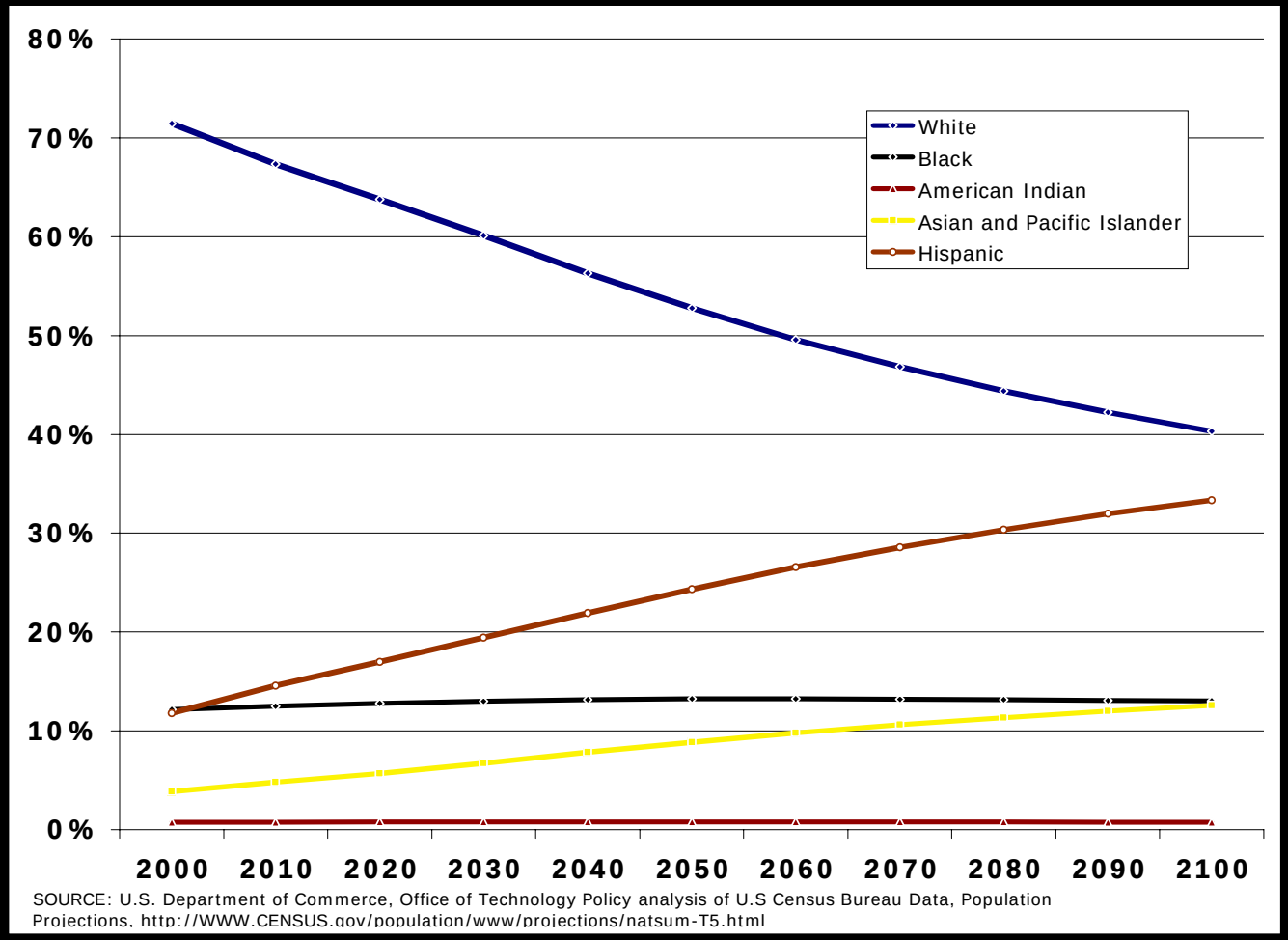
U.S. Race/Ethnic Composition, numbers



SOURCE: U.S. Department of Commerce, Office of Technology Policy analysis of U.S Census Bureau Data, Population Projections, http://WWW.CENSUS.gov/population/www/projections/natsum-T5.html

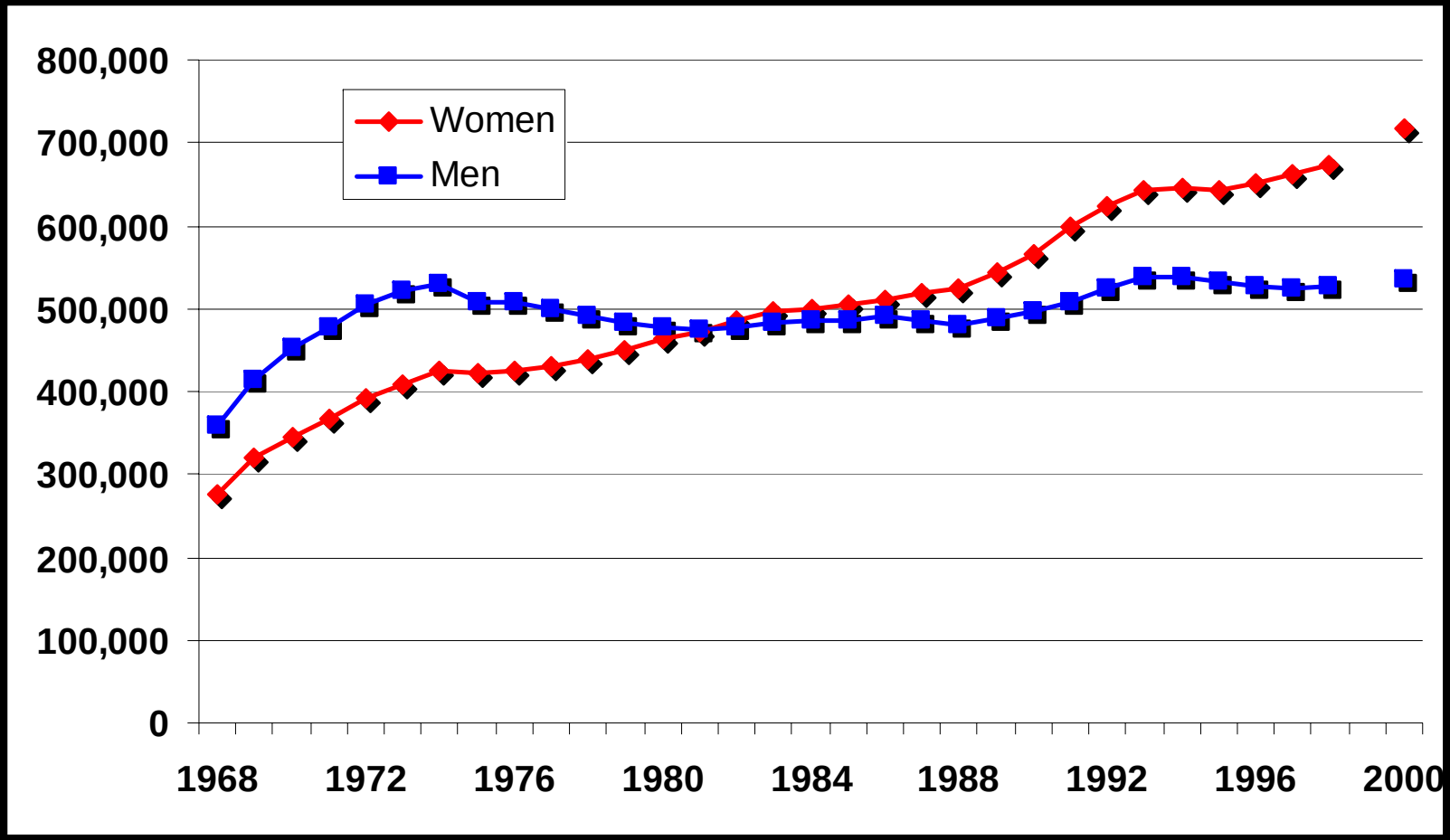
Census Bureau Projections Thru 2100

U.S. Race/Ethnic Composition, percent

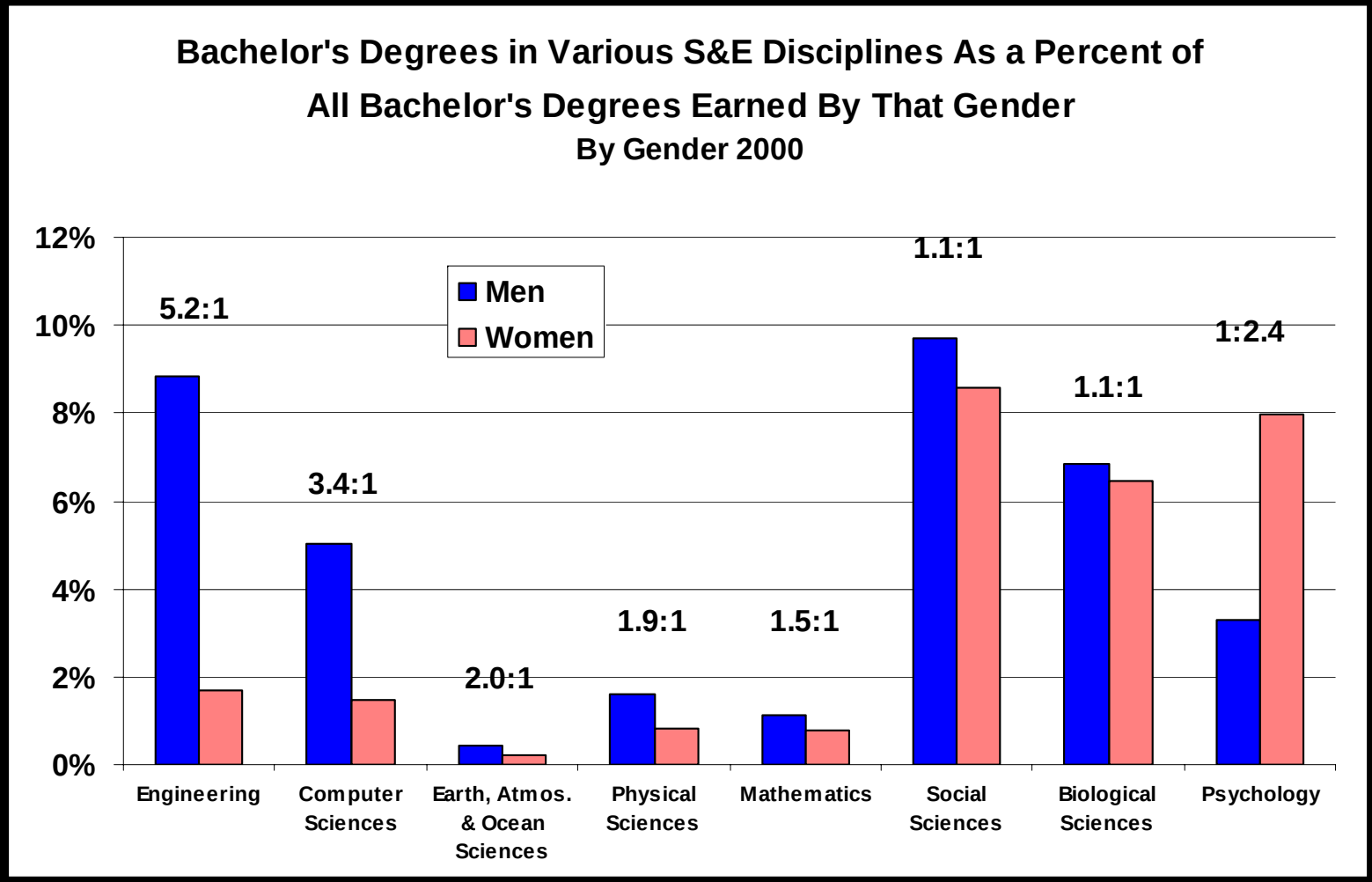


SOURCE: U.S. Department of Commerce, Office of Technology Policy analysis of U.S Census Bureau Data, Population Projections, http://WWW.CENSUS.gov/population/www/projections/natsum-T5.html

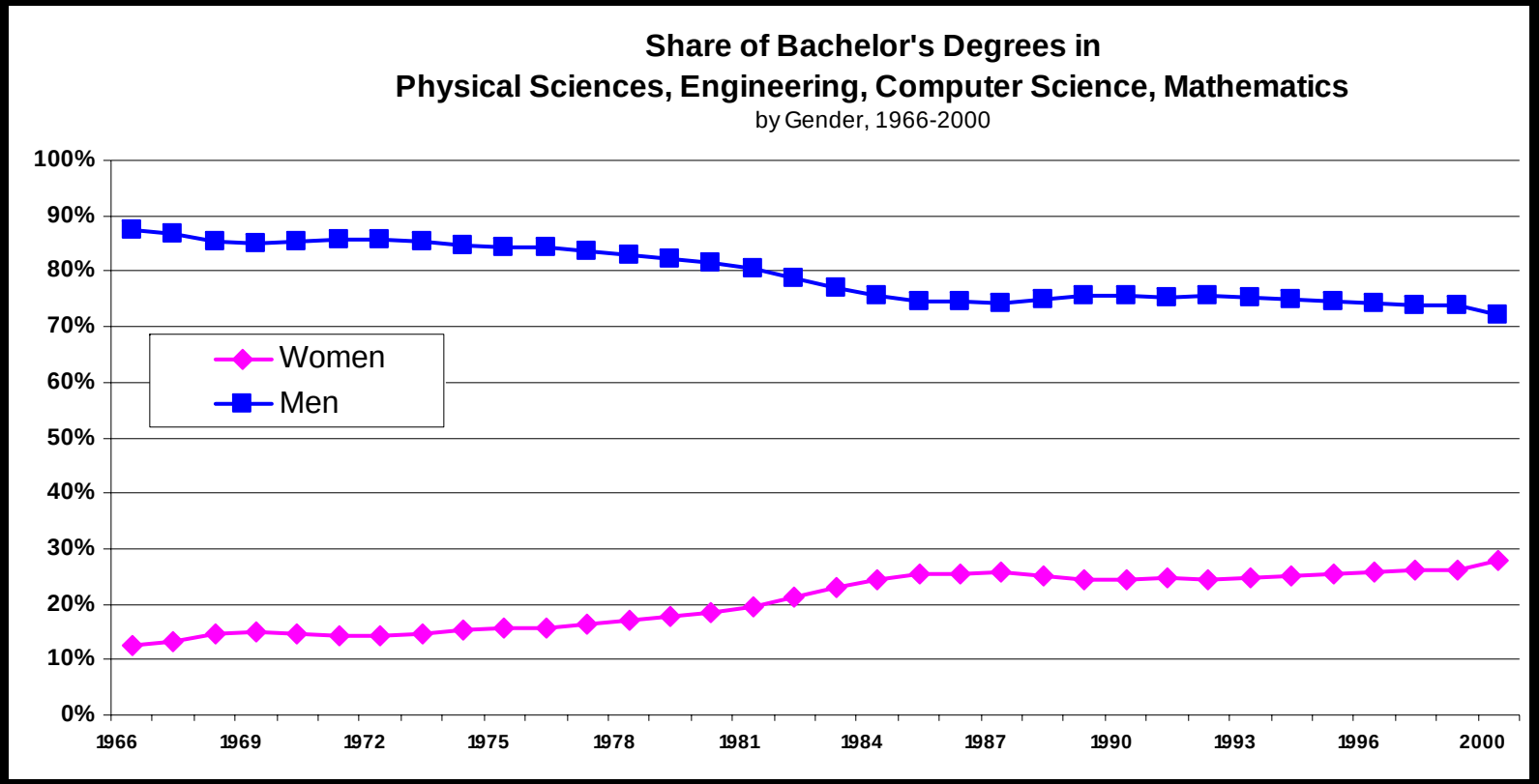
Bachelor's Degrees Awarded, by Gender



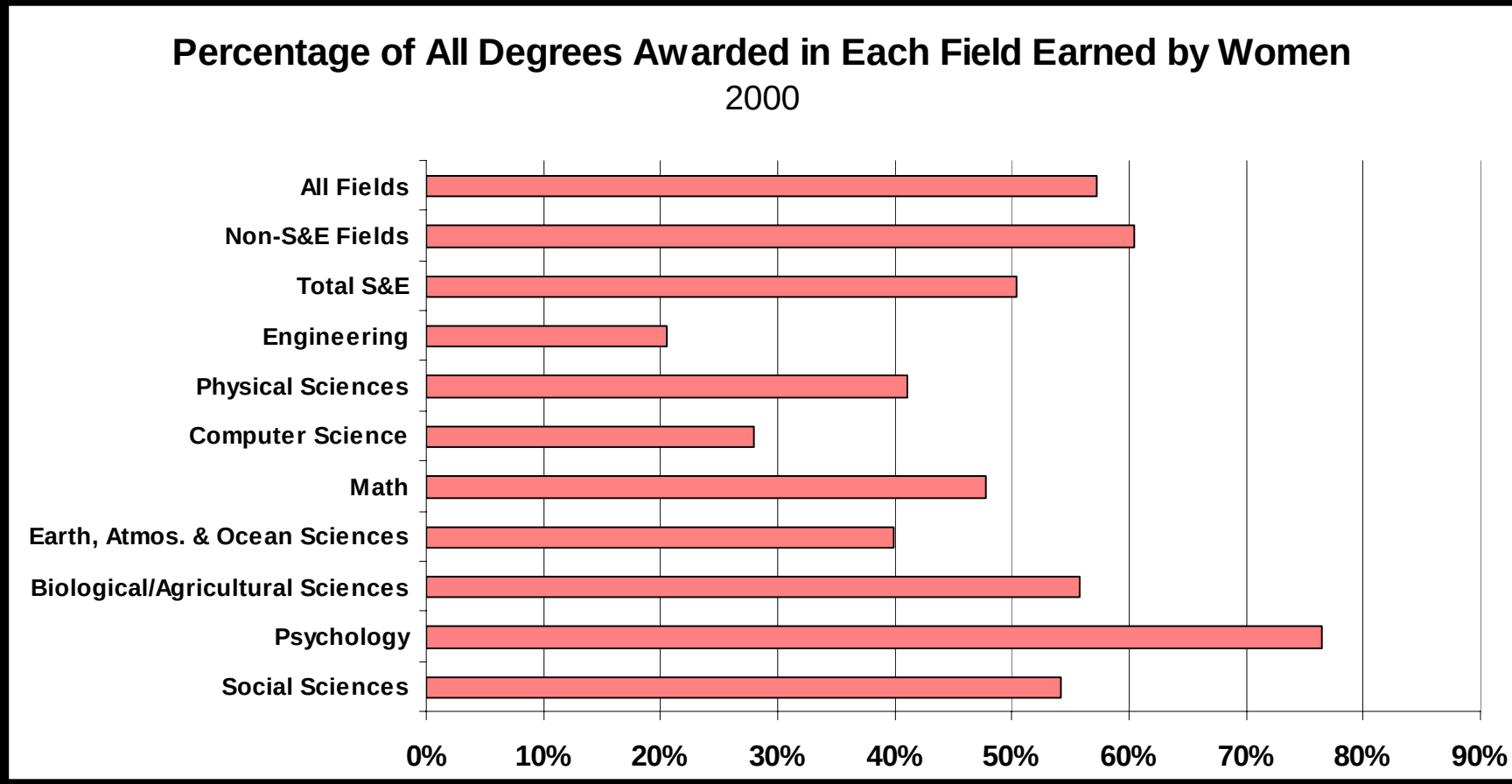
S&E Bachelor's Degrees, by Gender



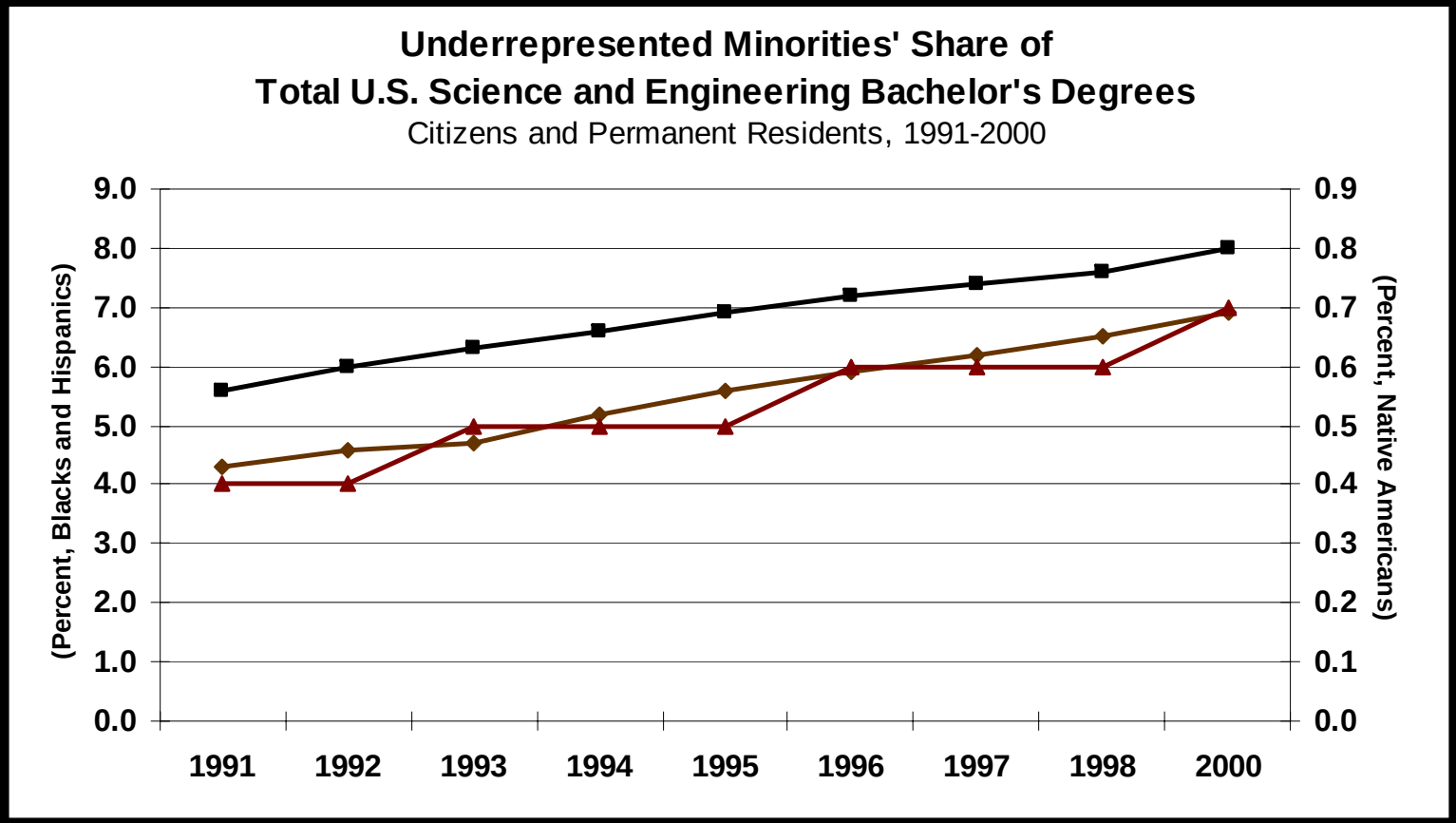
Women's Share of MEPS Bachelor's Degrees Growing, Still Comparatively Low



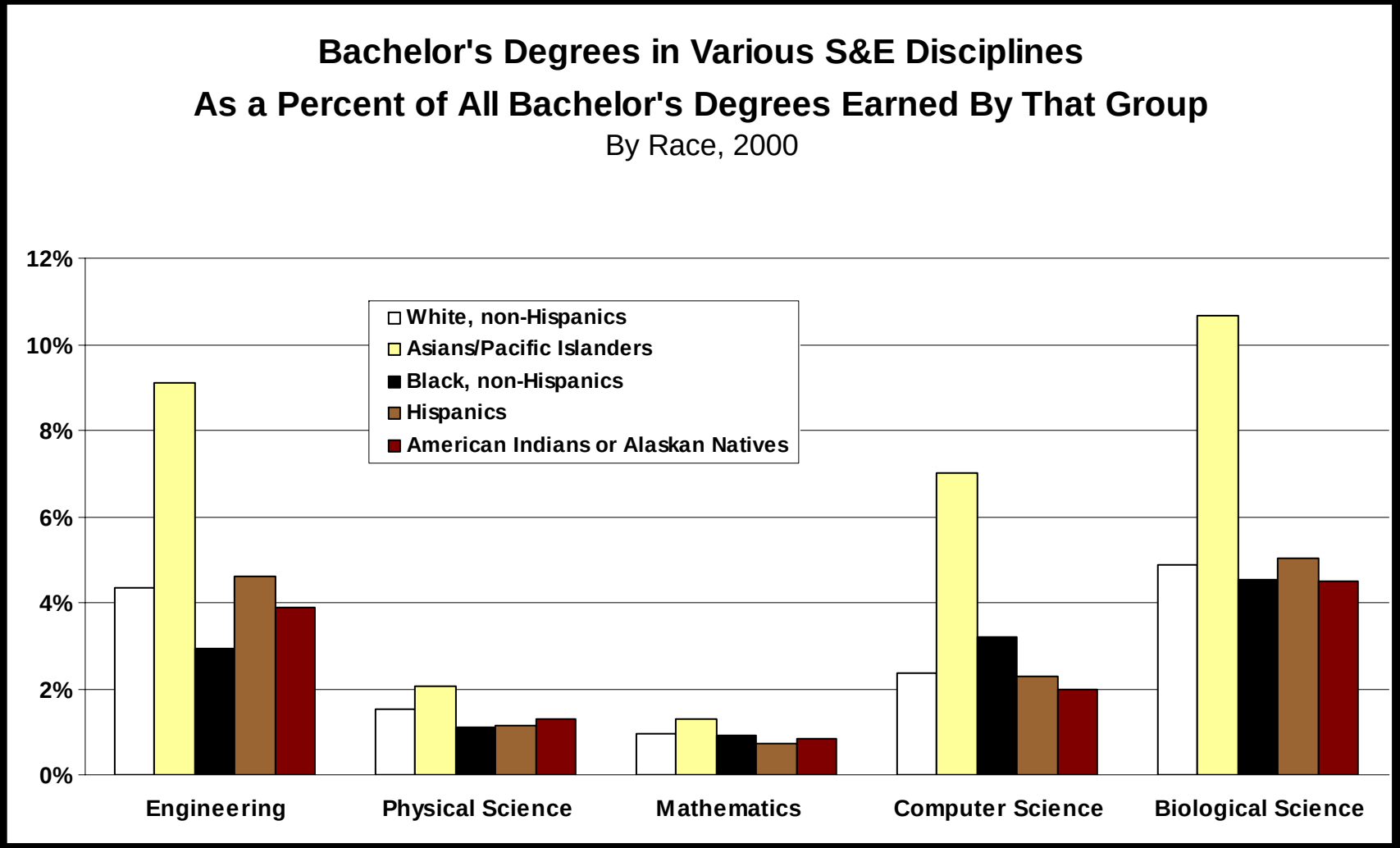
Share of Bachelor's Degrees in Each Field Earned by Women, 2000



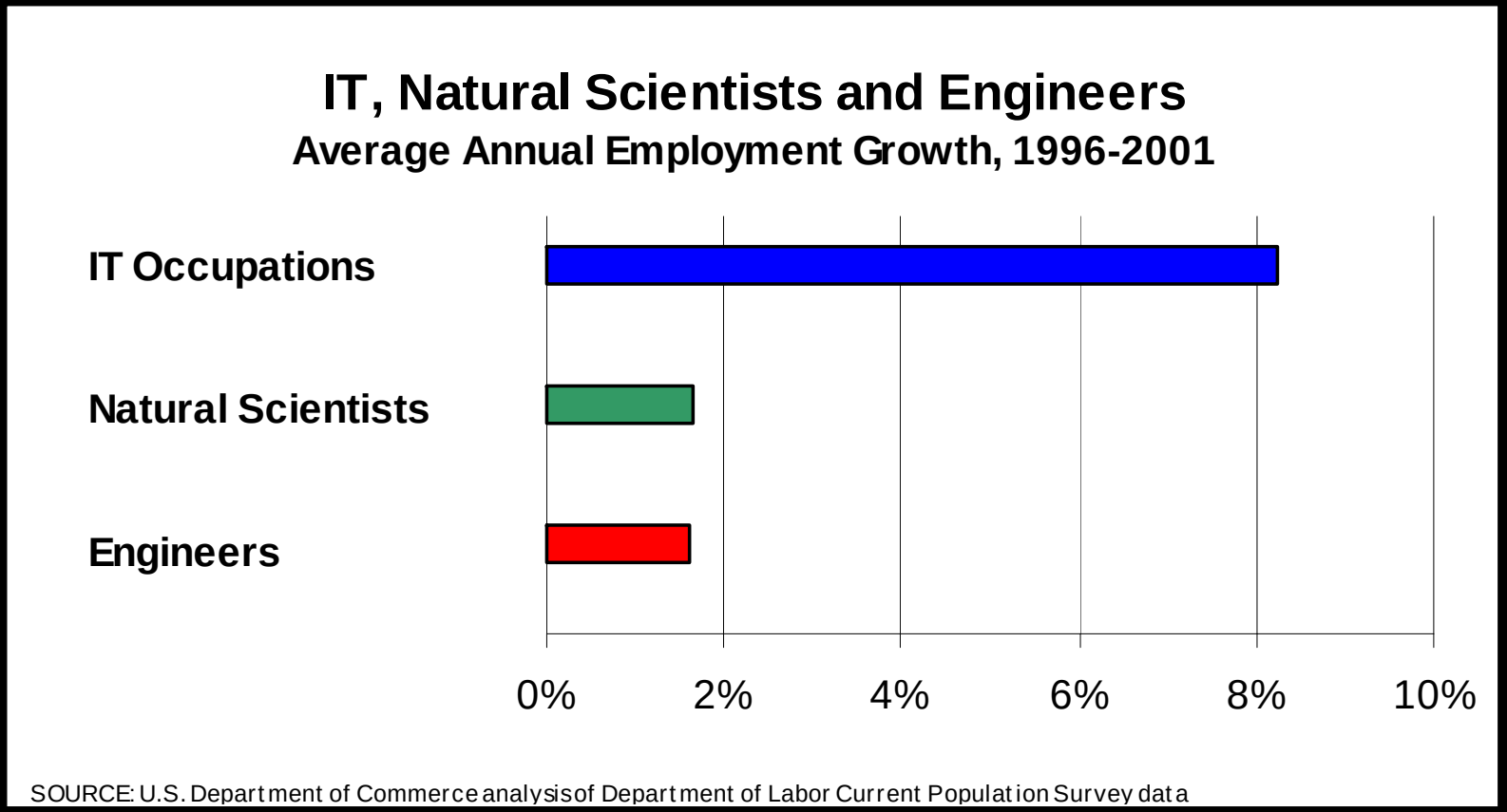
Share of Total U.S. S&E Bachelor's Degrees



S&E Bachelor's Degrees, by Race

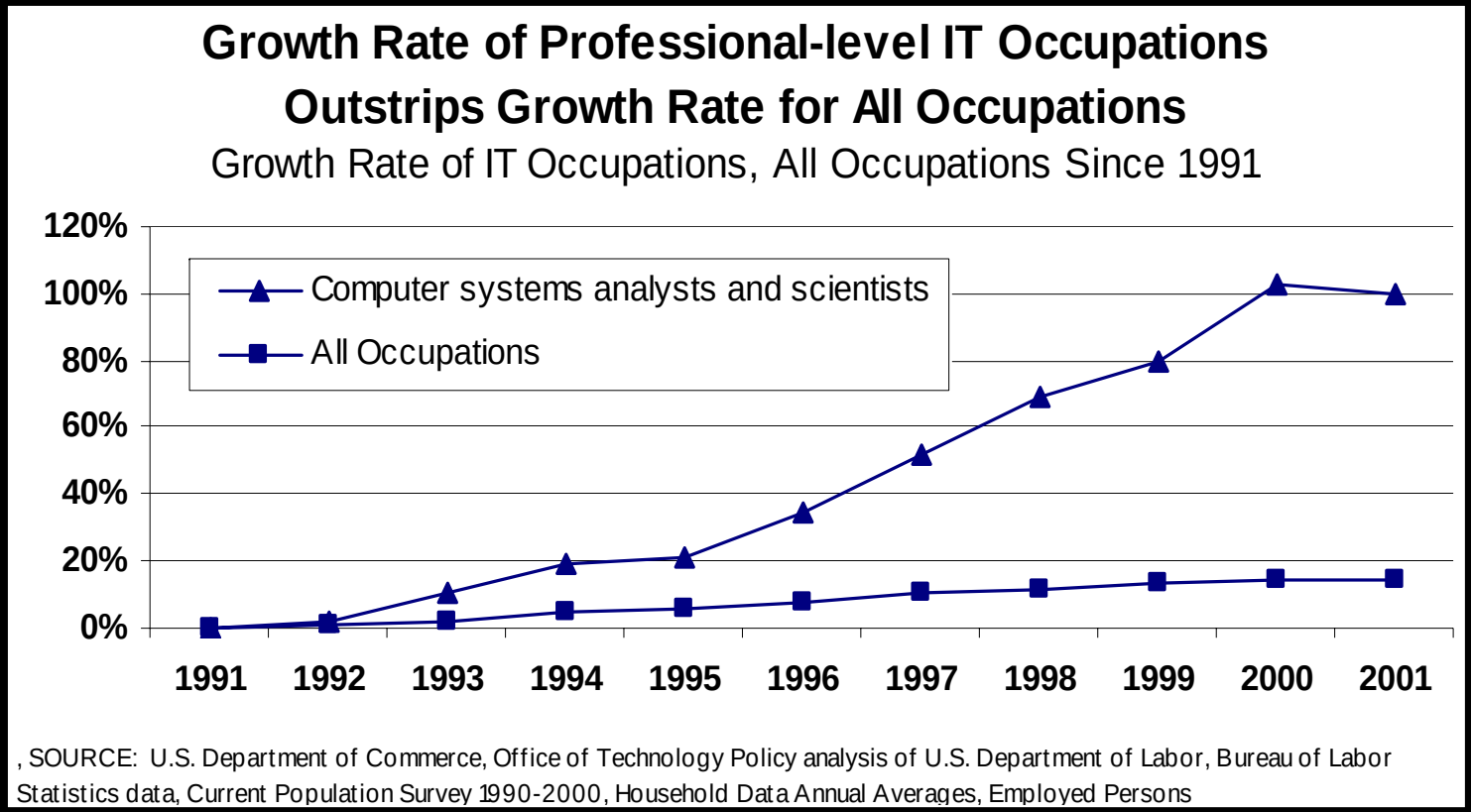


IT Occupational Growth Rate 5 Times Greater Than Natural Scientists, Engineers

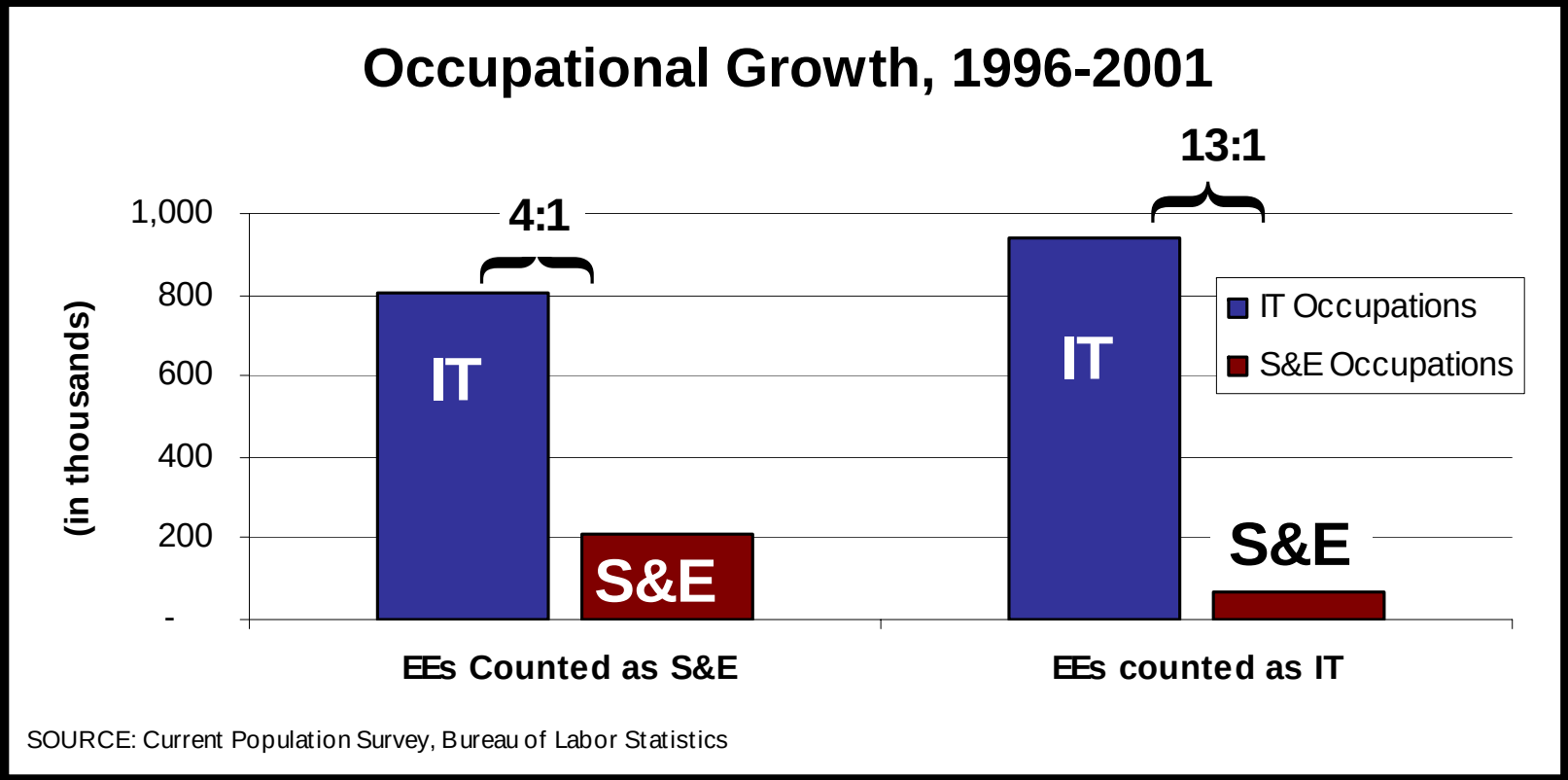


SOURCE: U.S. Department of Commerce analysis of Department of Labor Current Population Survey data

Occupational Growth Rates
IT vs. All Occupations

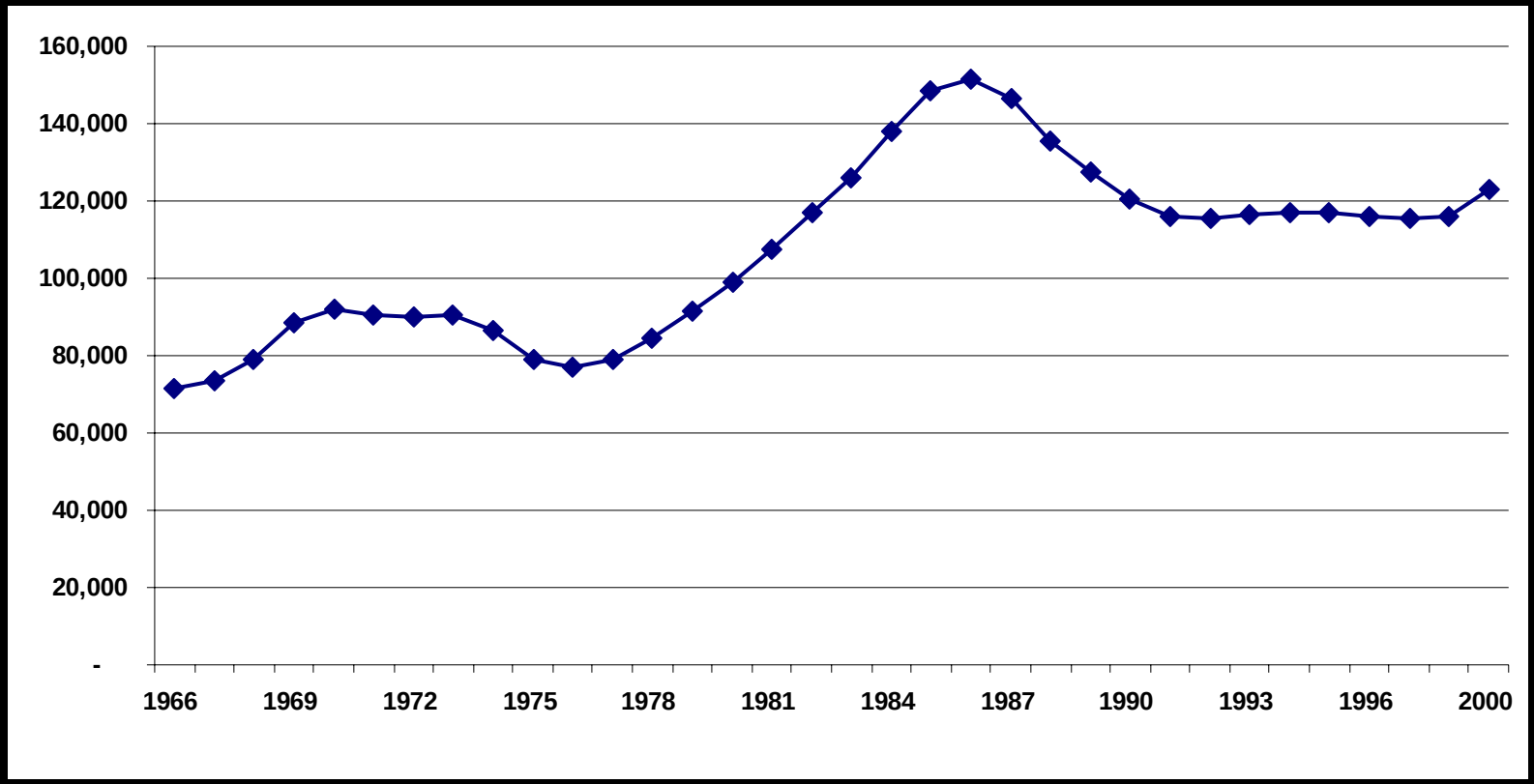


S&E Occupational Growth Dominated by Information Technology Occupations

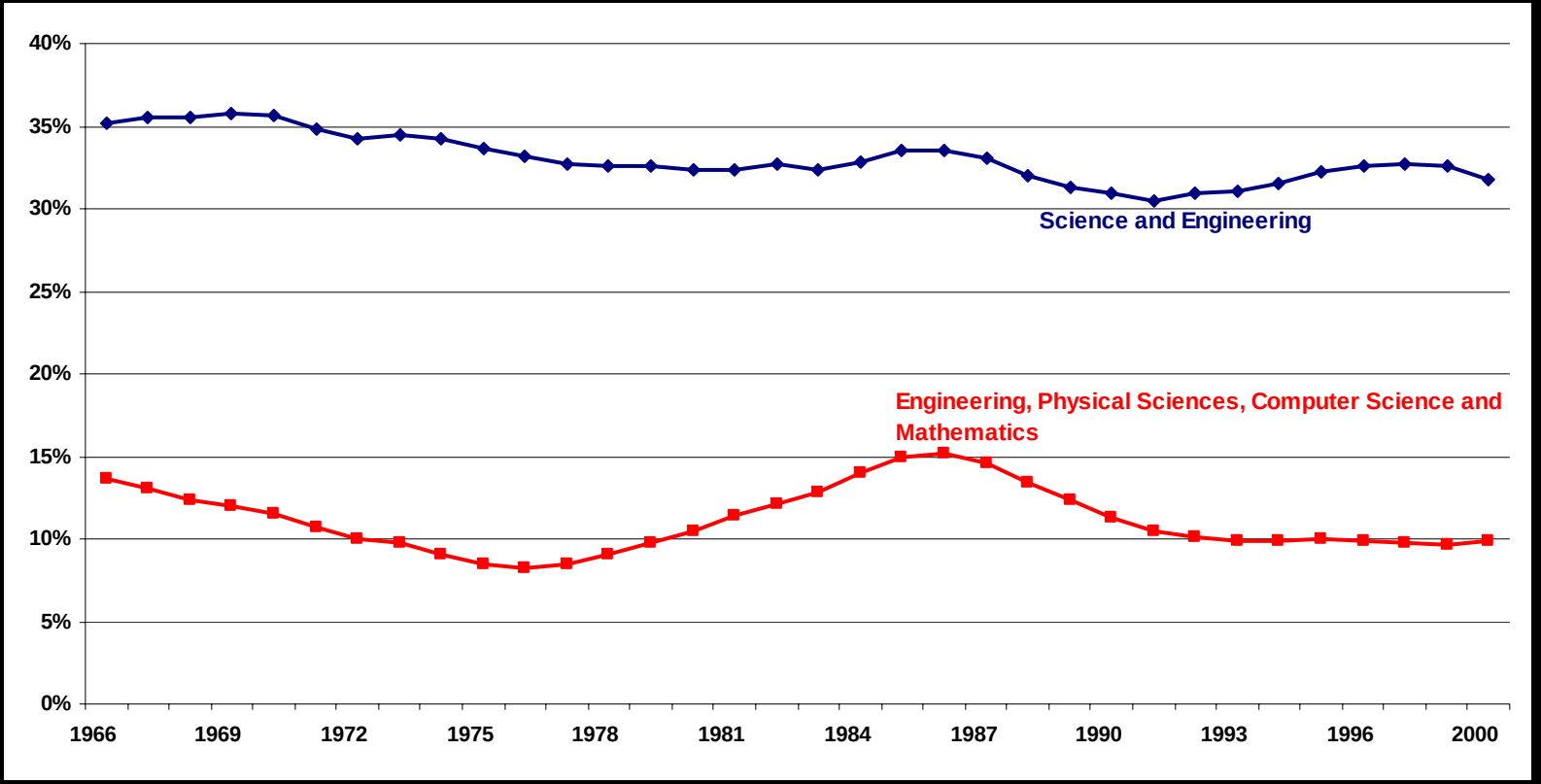


SOURCE: Current Population Survey, Bureau of Labor Statistics

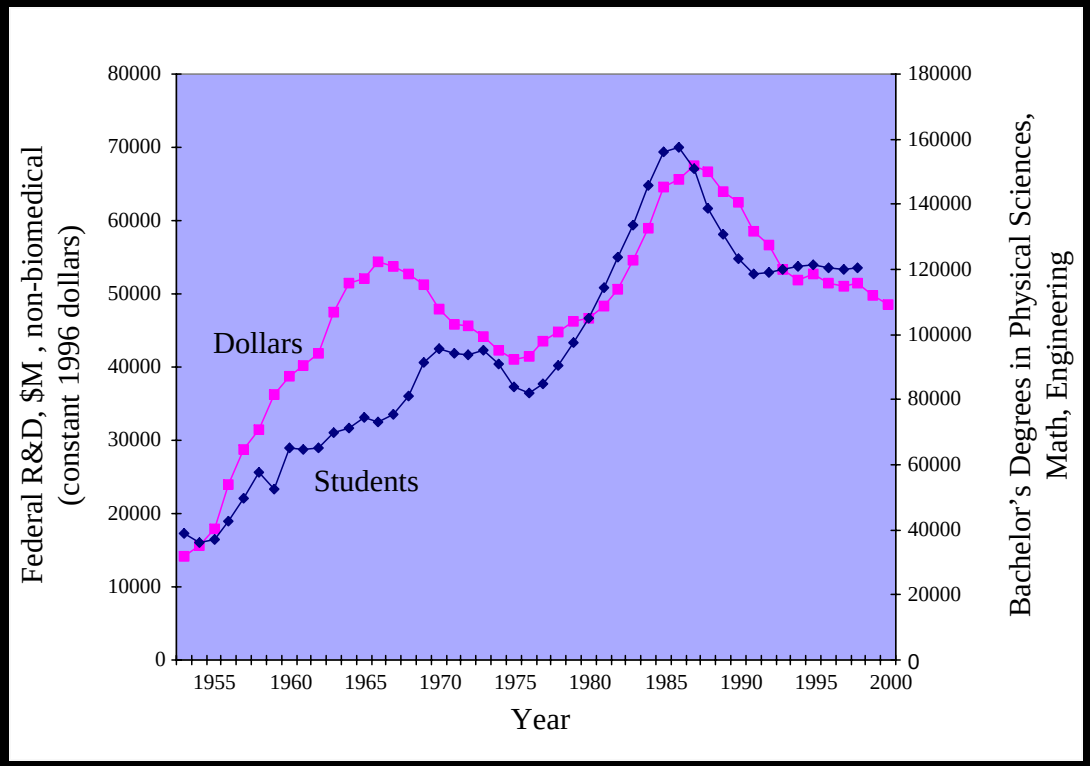
Total Bachelor's Degrees in Engineering, Physical Sciences, Computer Science and Mathematics Stable

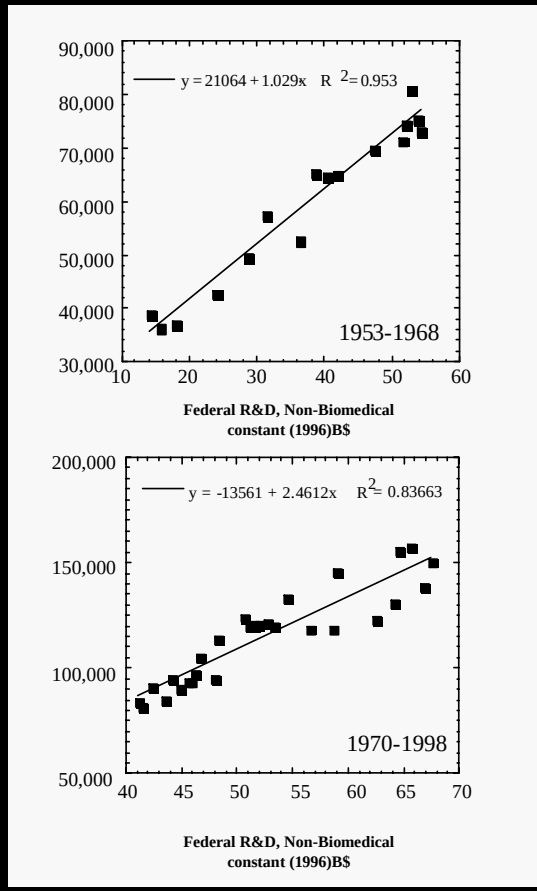


Science and Engineering, MEPS as a Share of All Bachelor's Degrees

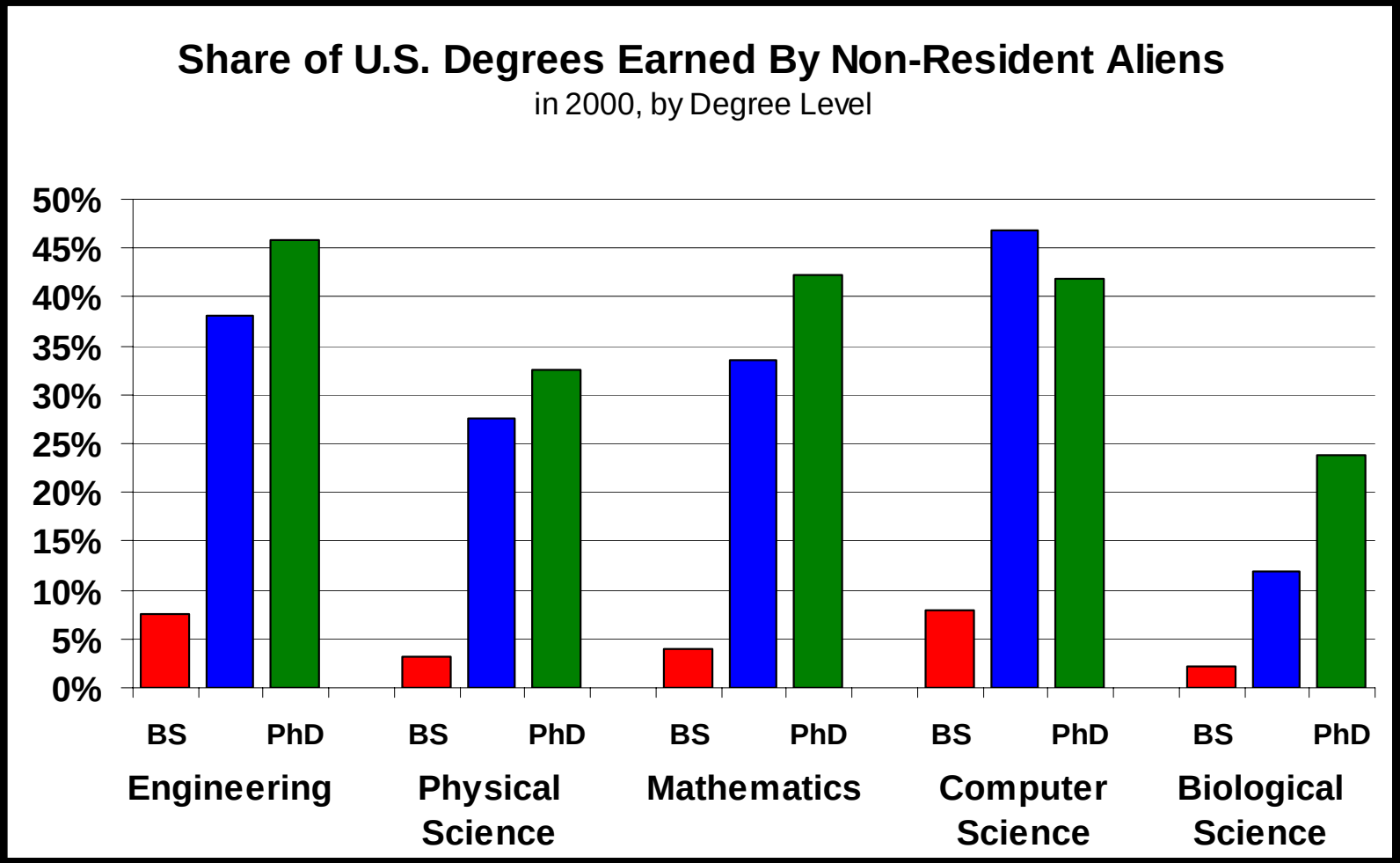


Strong correlation between Federal R&D investments in MEPS and bachelor's degree production in MEPS fields

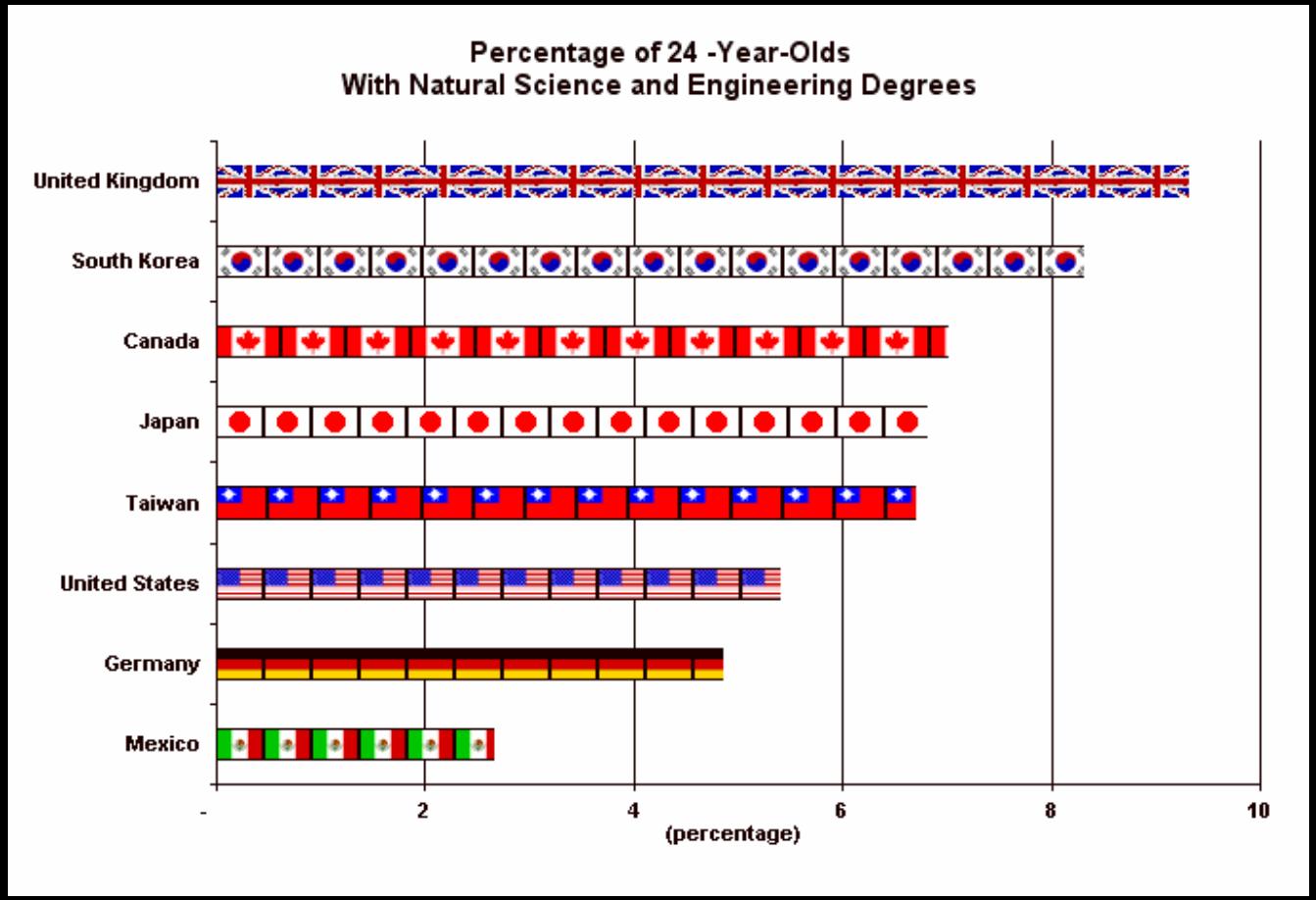




Share of Total S&E Degrees Earned by Non-Resident Aliens, by Degree Level



U.S. Lags Other Nations in Share of 24-Year-Olds With Natural Science, Engineering Degrees



Also: **The United States ranks 61st out of 63 nations in the share of S&E degrees as a total of all bachelor's degrees.**