



Snapshot of the Global Networking and Information Technology (NIT) Ecosystem

Briefing Computing Leadership Summit 2007

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Introduction



- Charged with compiling a data-driven snapshot of the global NIT ecosystem -- US vis-à-vis current and emerging competitor countries*
- Short turnaround -- July 2006-October 2006
 - Single pass-through
 - Using publicly available data sources
- Today's briefing – highlights/extracts from the data collected

* China, France, Germany, India, Ireland, Japan, Netherlands, Singapore, South Korea, United Kingdom, and European Union as an emerging cluster competitor

Data Sources and Definition



Data

- Authoritative public sources (e.g., NSF, OECD, World Bank)
 - Tend to have older data
 - Complemented by others for more recent information (e.g., National Venture Capital Association, EU governments)

Key definitions

- Networking and Information Technology (NIT)
 - Information and Communication Technology (ICT) = NIT +
 - Telecommunications services
 - Select telecommunications equipment
- ... but a lot of flux due to evolving nature of the space (e.g., media, publishing, online retailing, emerging services)*

NIT Ecosystem

Components and Sub-Components



Research and Development

Investment
Performers
Outputs
Enabling Infrastructure
for R&D

NIT Infrastructure

Technology Penetration
e-Government

Skilled Workforce

Population
Workforce
Education

NIT Producers and Consumers

Enabling Factors

Access to Capital
Economic Stability
Socio-Cultural Influences

Legal Regulatory Environment

Tax Structure
IP/Other Regulations
Corruption

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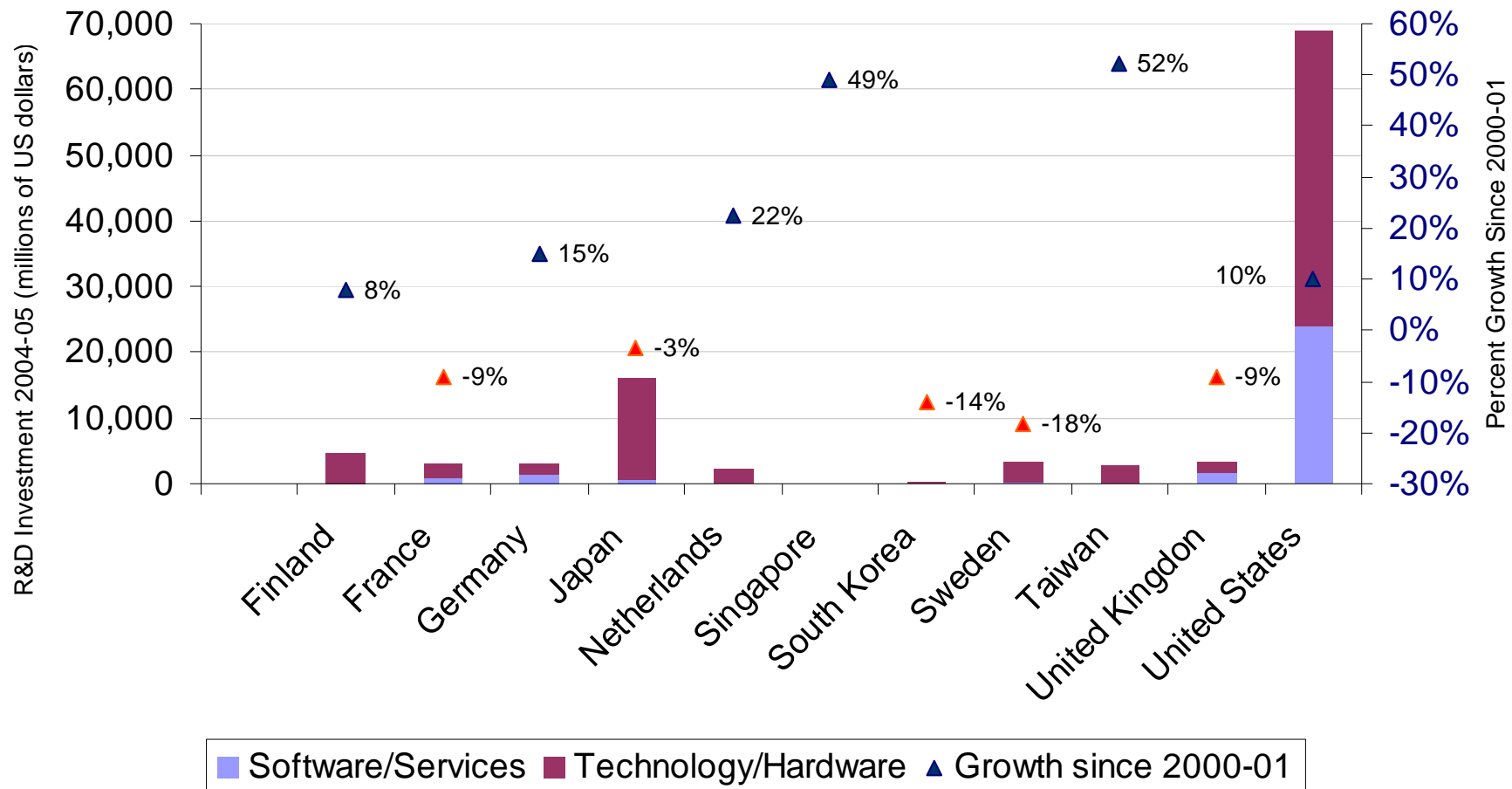
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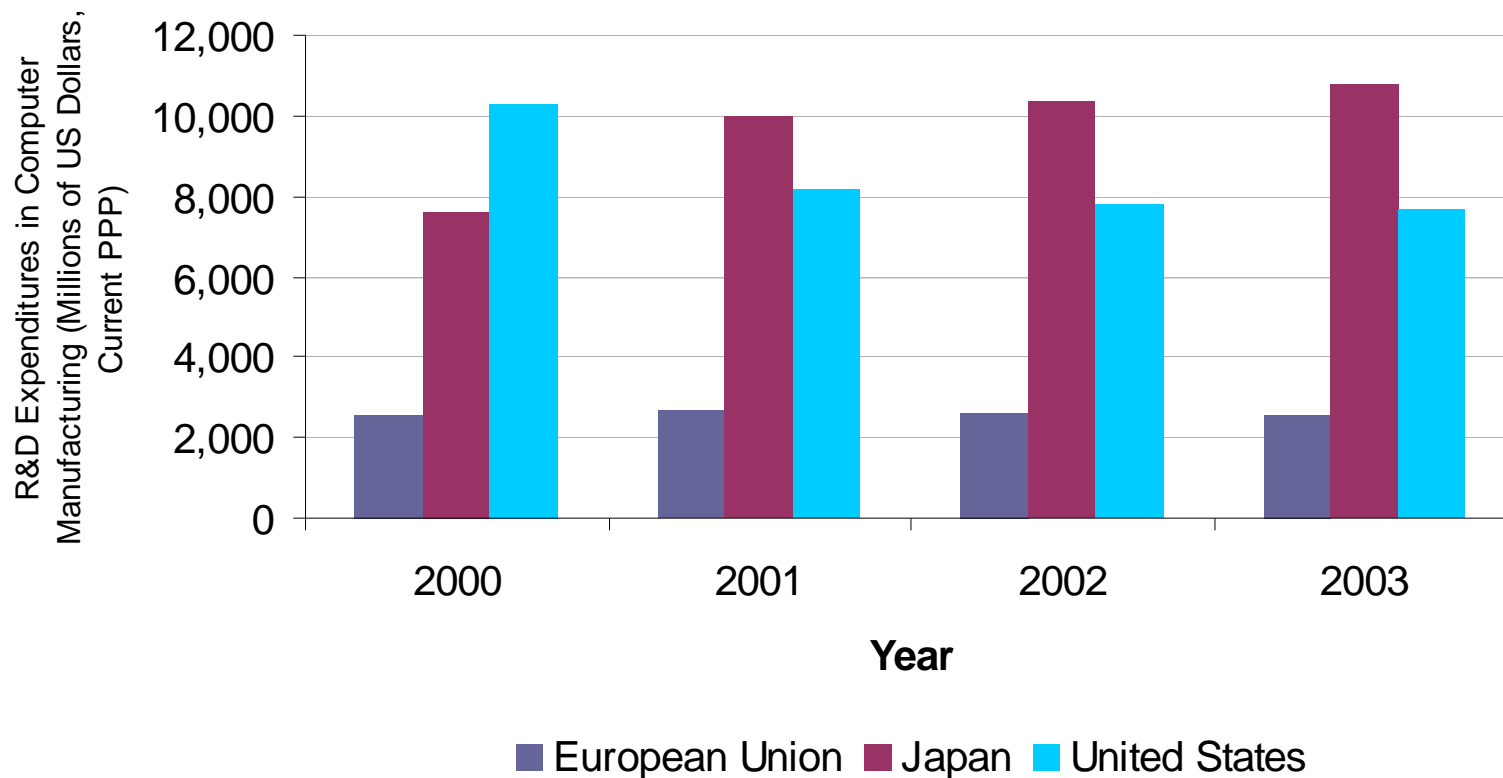
R&D Investments and Outputs

Overall, U.S. firms in NIT sectors spend much more on R&D than firms in other nations, with strong growth...



Notes: Firms among the top 1,250 R&D spending firms in the world. Software and services: 225 firms. Technology hardware and equipment: 268 firms.
 Source: UK Department of Trade and Industry R&D Scoreboard, 2006

...but R&D spending in some sub-sectors has declined



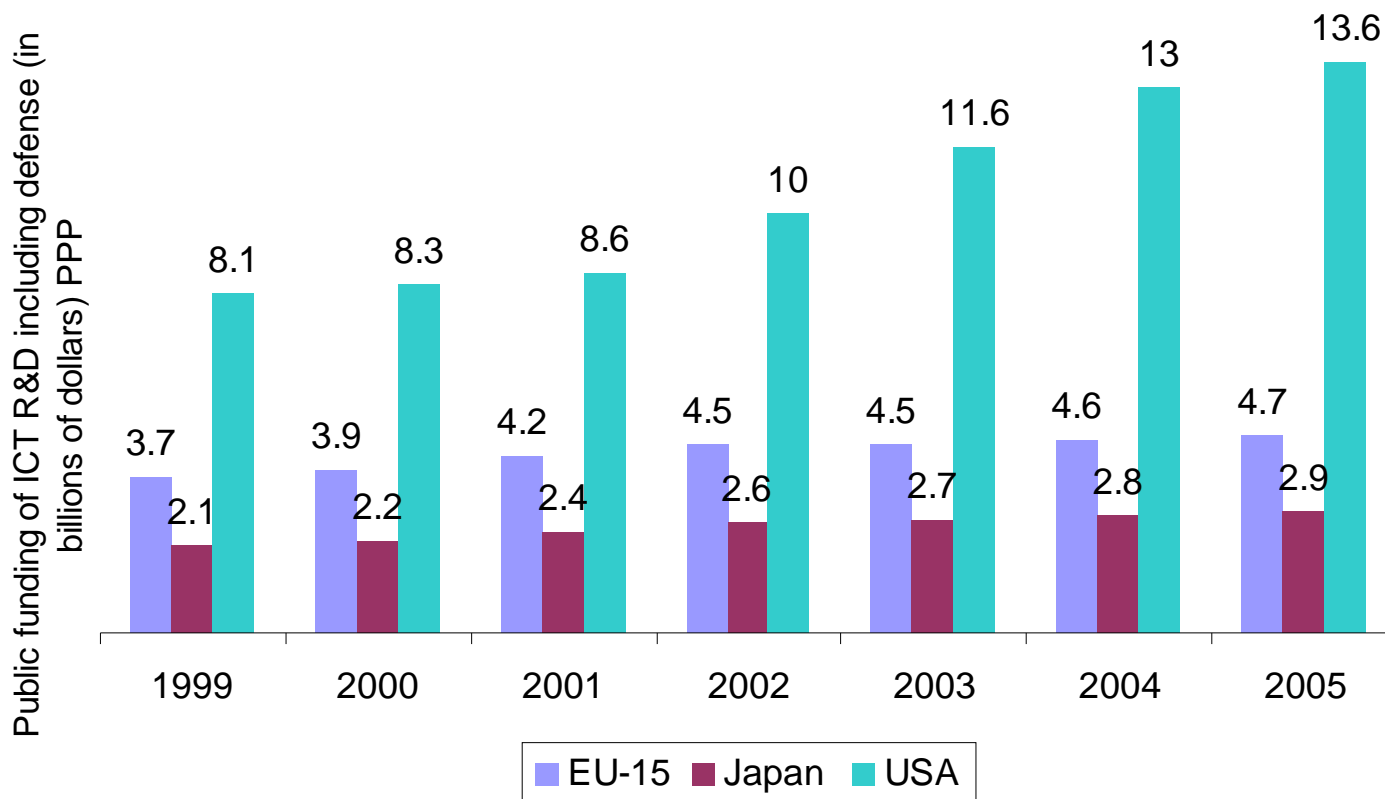
Notes: ISIC Category 30 Computer Manufacturing

Classification is according to the International Standard Industrial Classification (ISIC Rev.3) or nearest national classification.

PPP stands for Purchasing Power Parity, which standardized purchasing power across international currencies. Conversion rates from OECD Statistics Directorate, April 2006.

Source: OECD ANBERD Database, 2006

Public funding of ICT R&D – including defense - in the United States is well ahead of other economies of interest



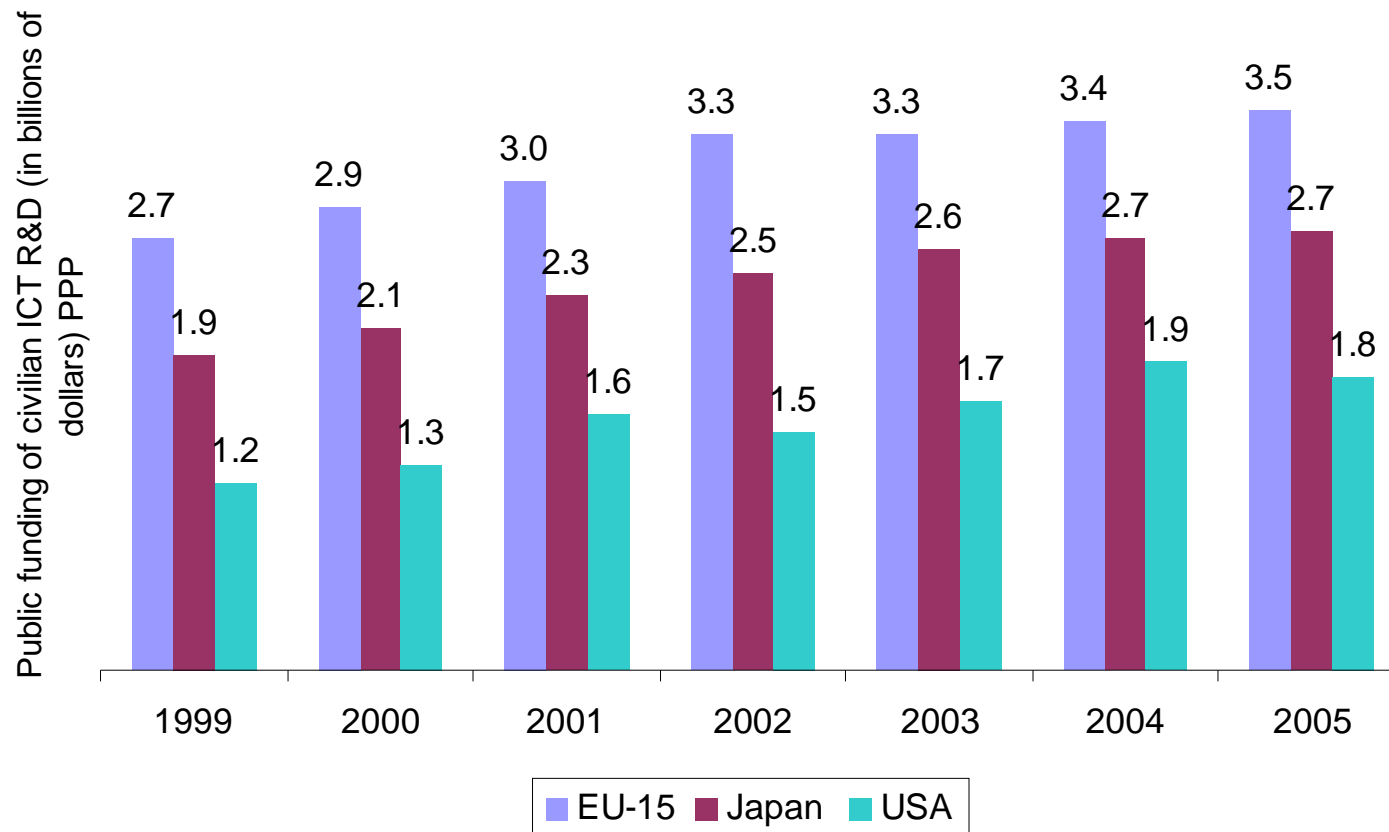
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There are varying estimates of public sector R&D across sources and no recent authoritative source.

Source: Research And Development In Information Science and Technology In Large Industrialised Countries, Commissioned By The Ministère Délégué À L'enseignement Supérieur Et À La Recherche, Summary Report April 2006

Excluding defense, public U.S. ICT funding may be lower than other economies of interest

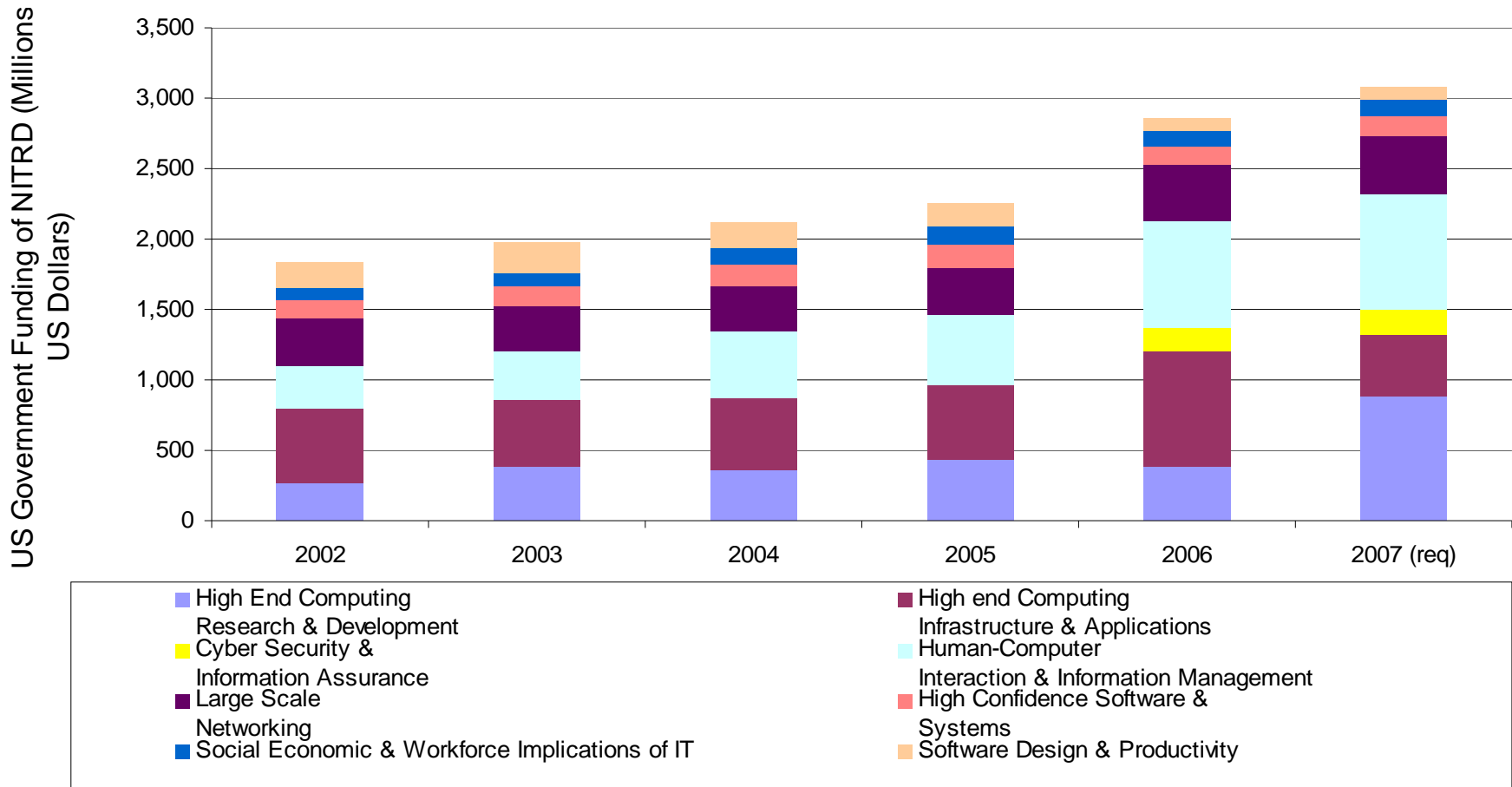


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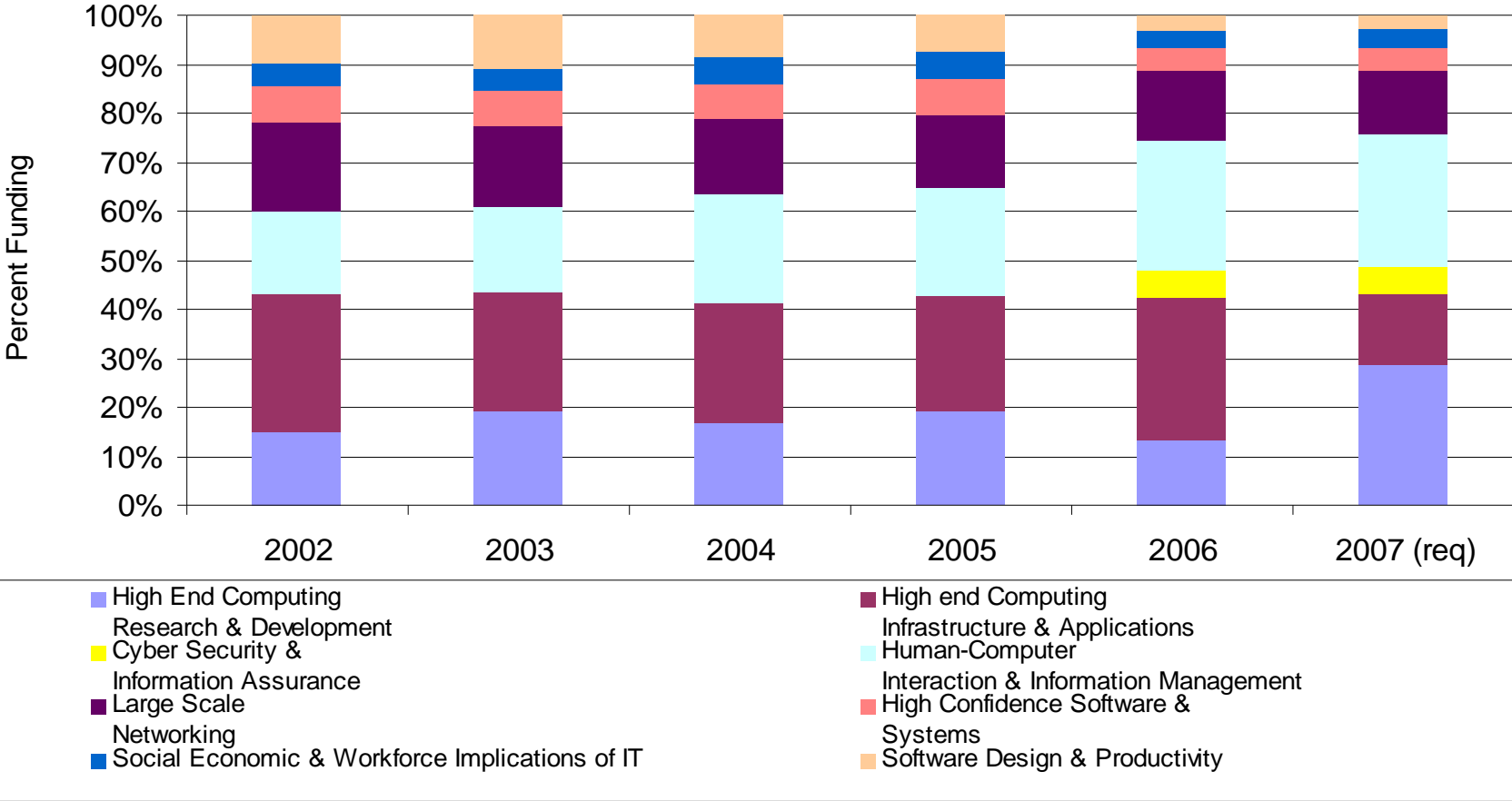
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U.S. federal funding of unclassified NIT R&D has been growing



Under half of U.S. federal funding of unclassified NIT R&D supports high end computing

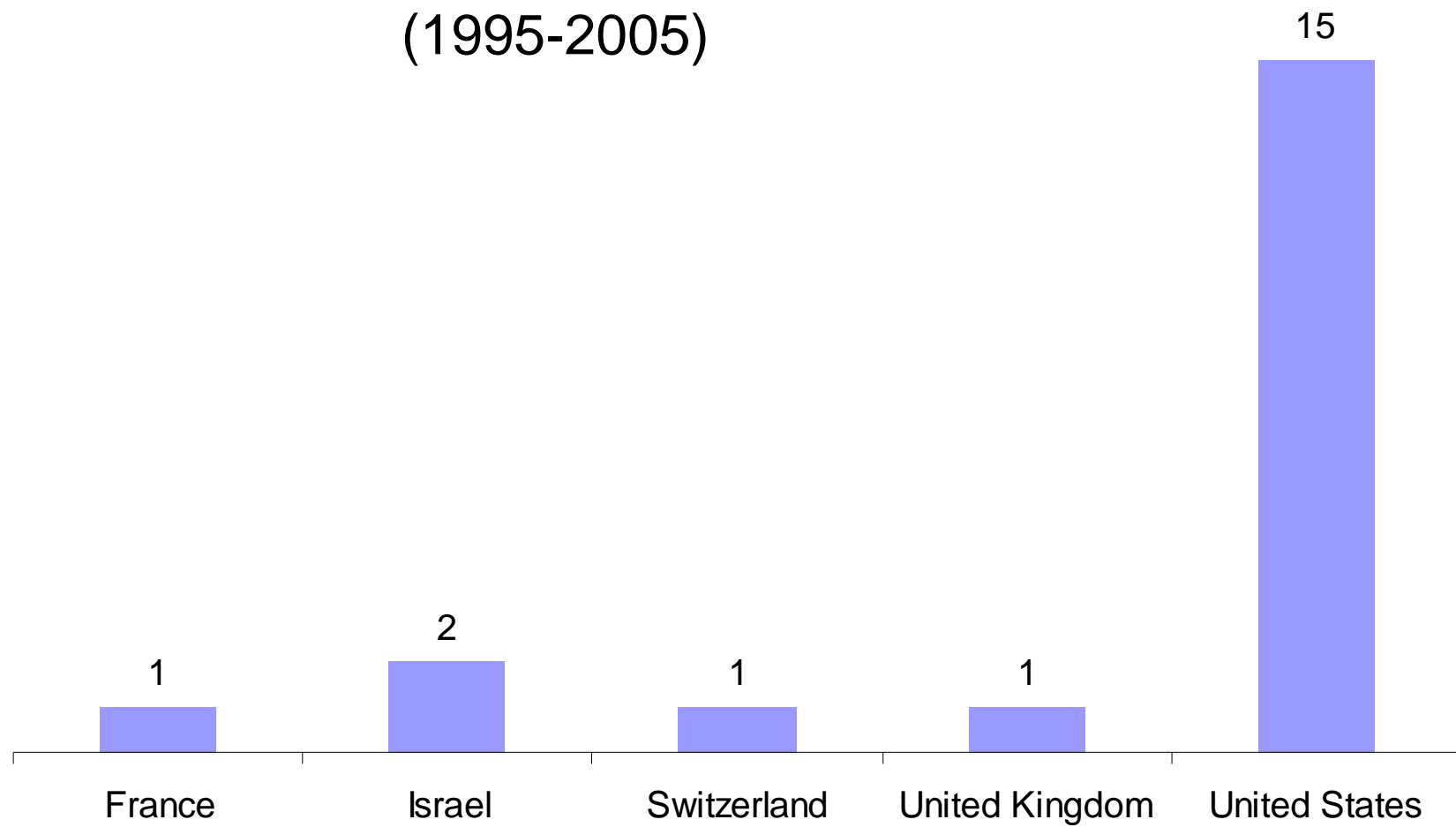


Source: NITRD NCO, 2002-2006

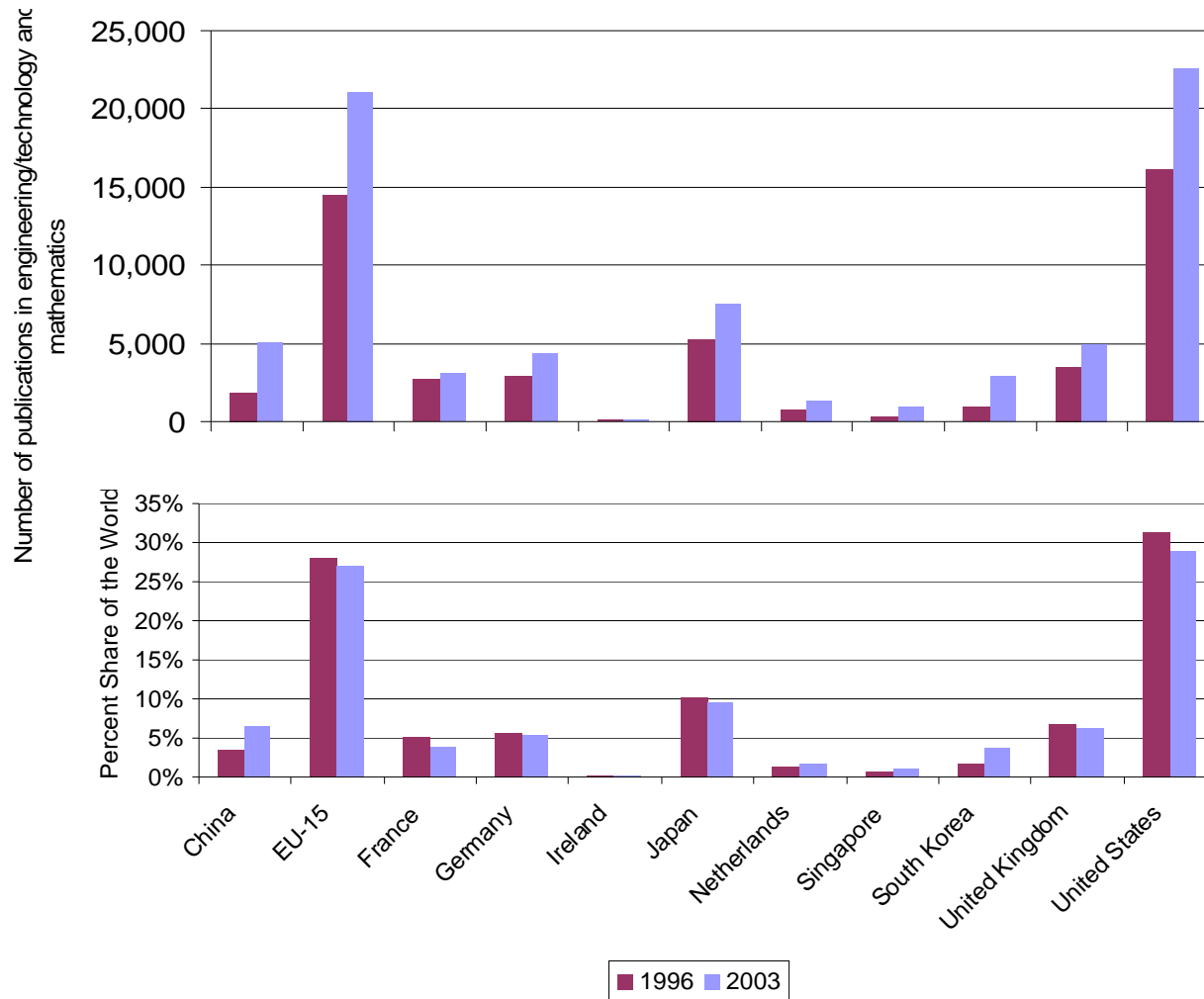
Majority of the most-cited computer science researchers and institutions are in the United States



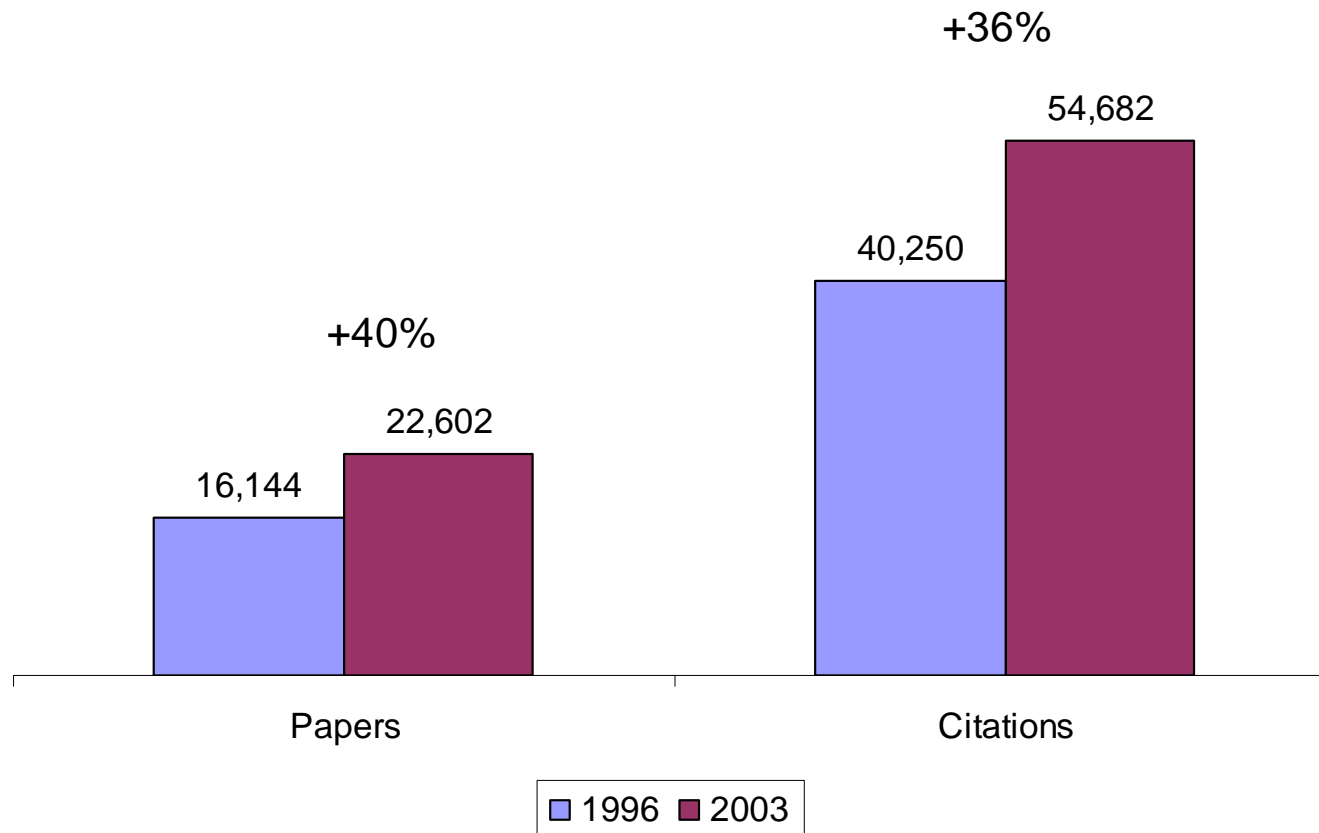
Most-cited institutions in computer science (1995-2005)



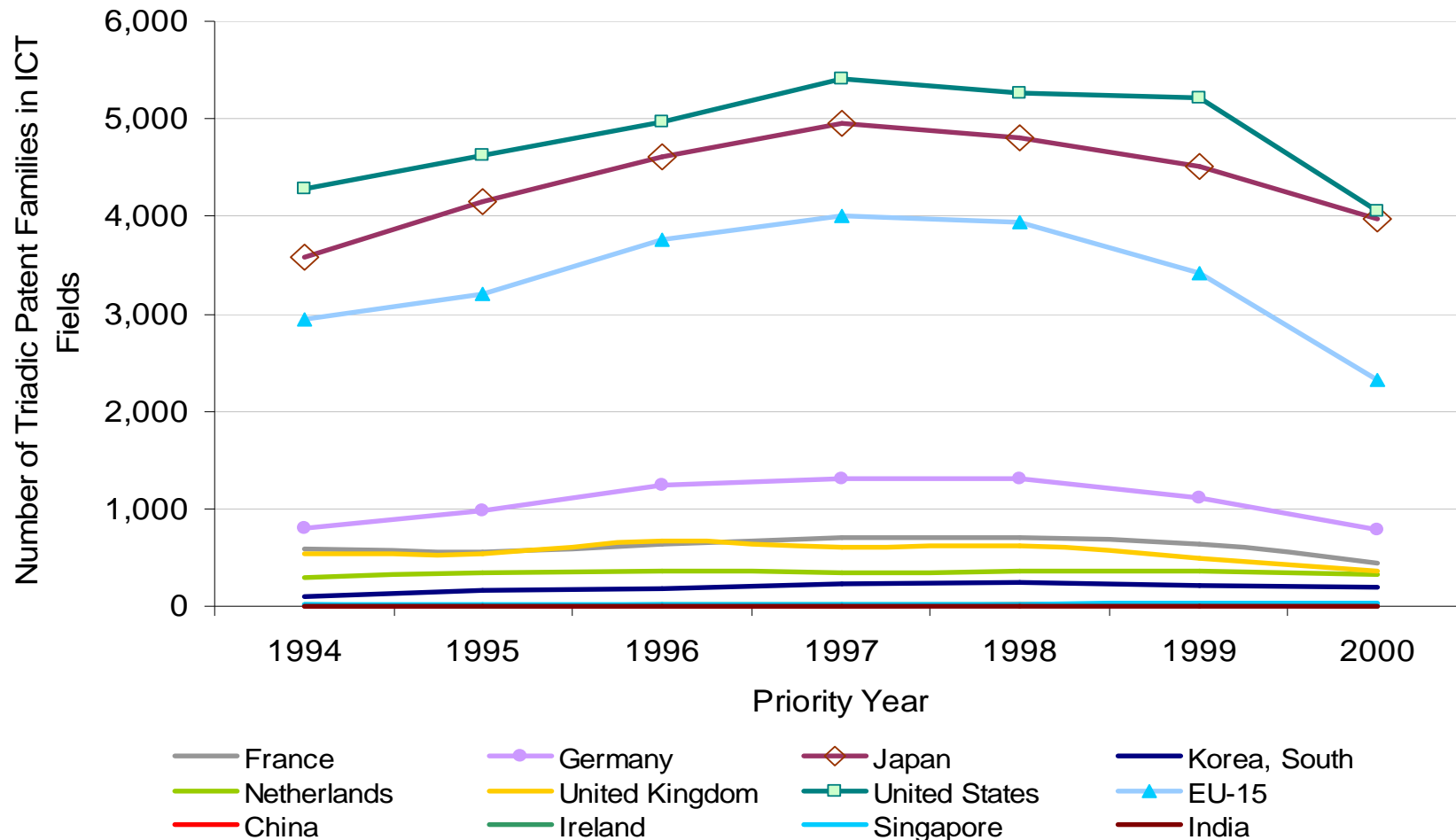
U.S. publications in technology and math have gone up but U.S. share of the world total is down



Growth of U.S. citations slightly lower than the growth of U.S. publications

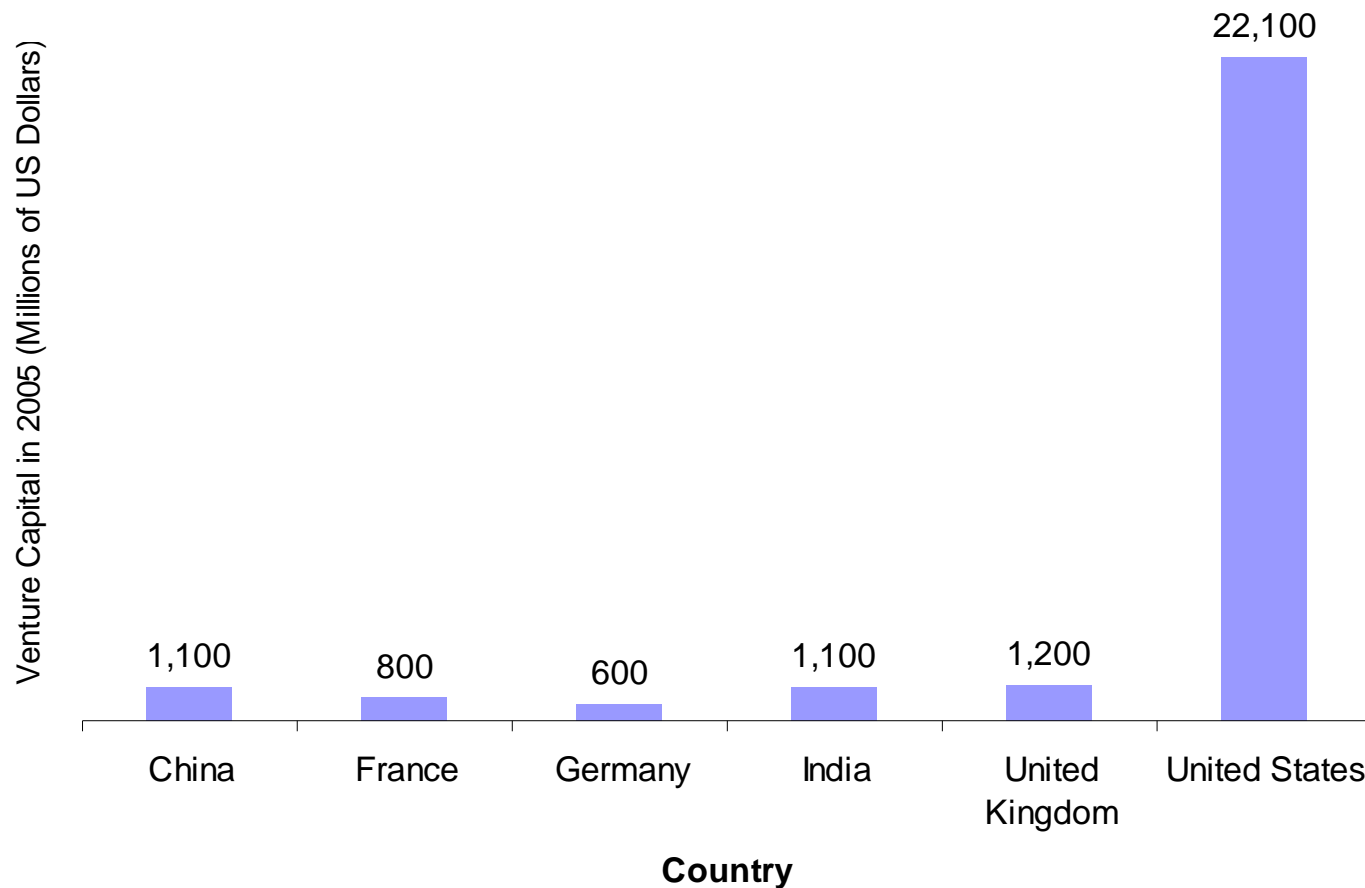


United States leads the world in the number of Triadic Patent Families in ICT fields

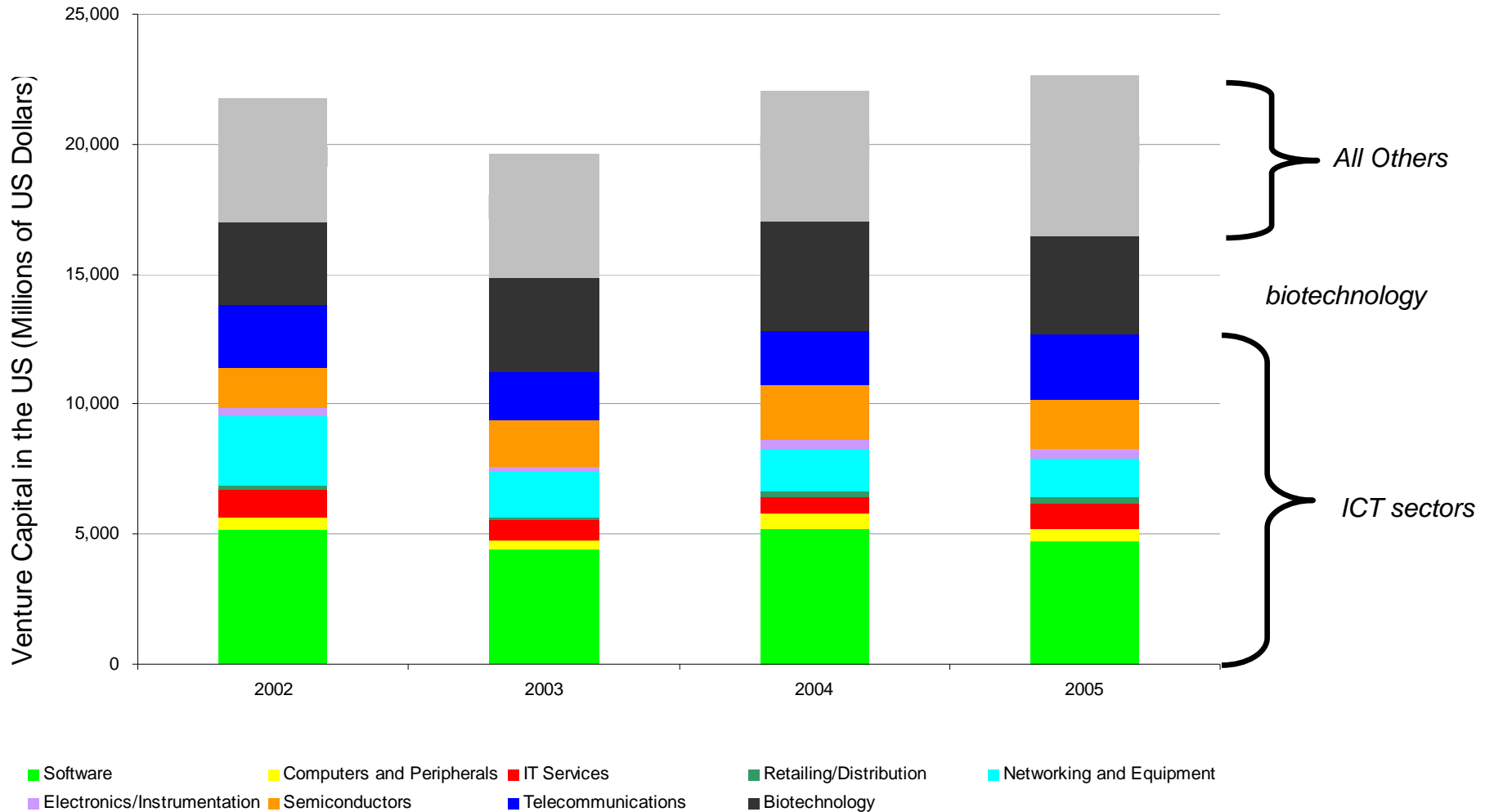


Availability of Capital

More venture capital is available in the United States than any other country in the world

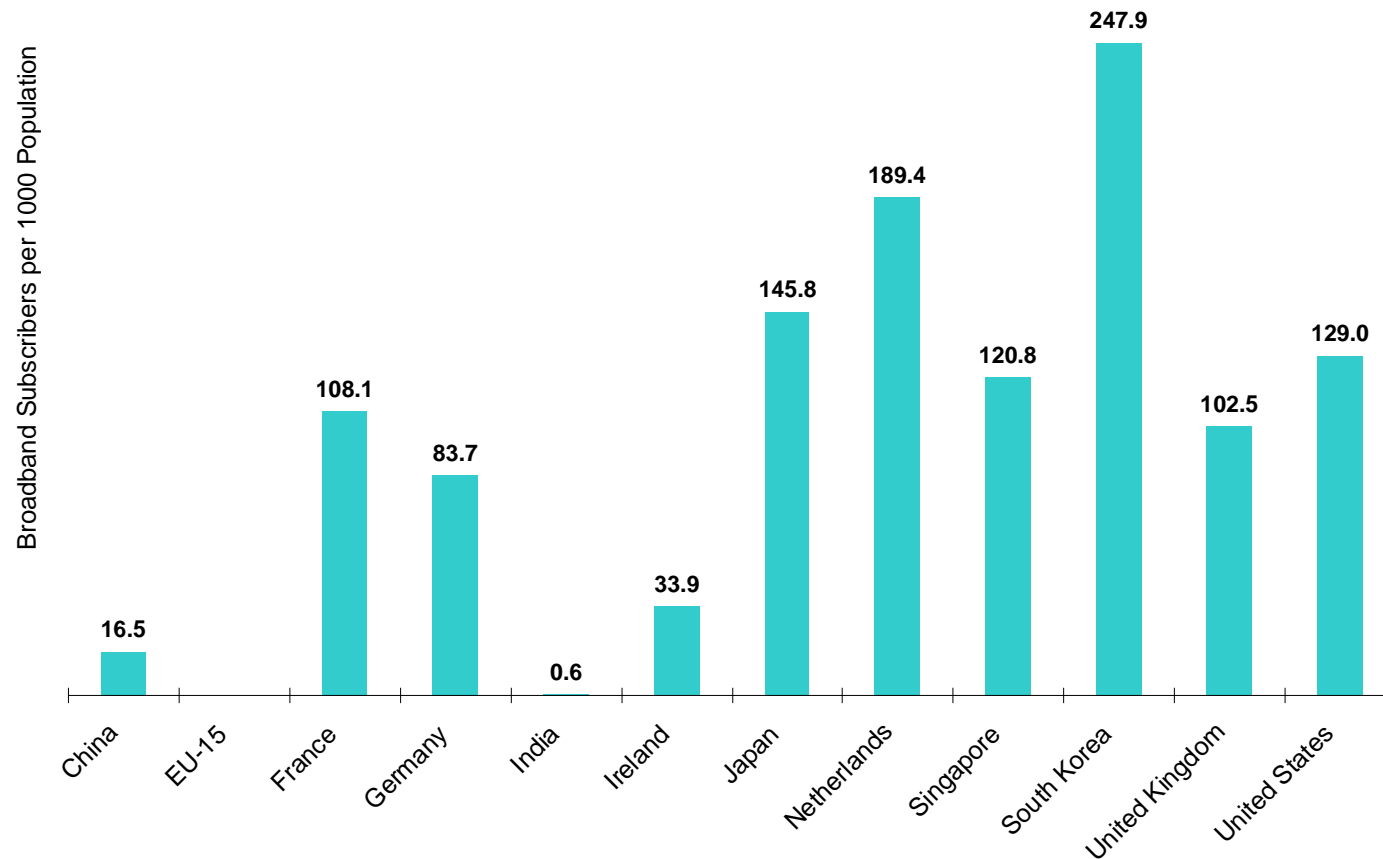


In the United States, venture investment in technology sectors is large and stable



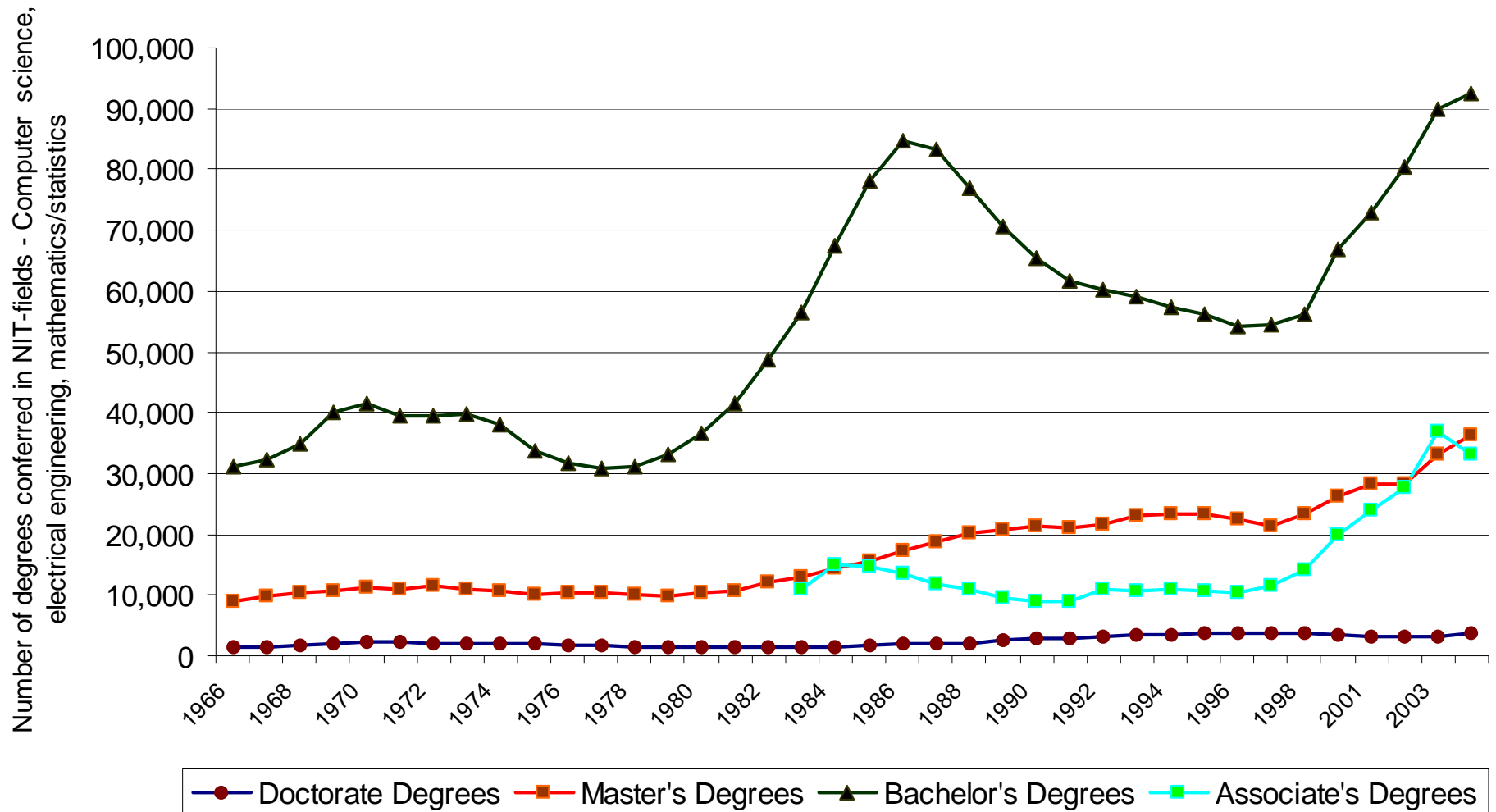
Infrastructure

Broadband penetration in the United States is lower than many other nations



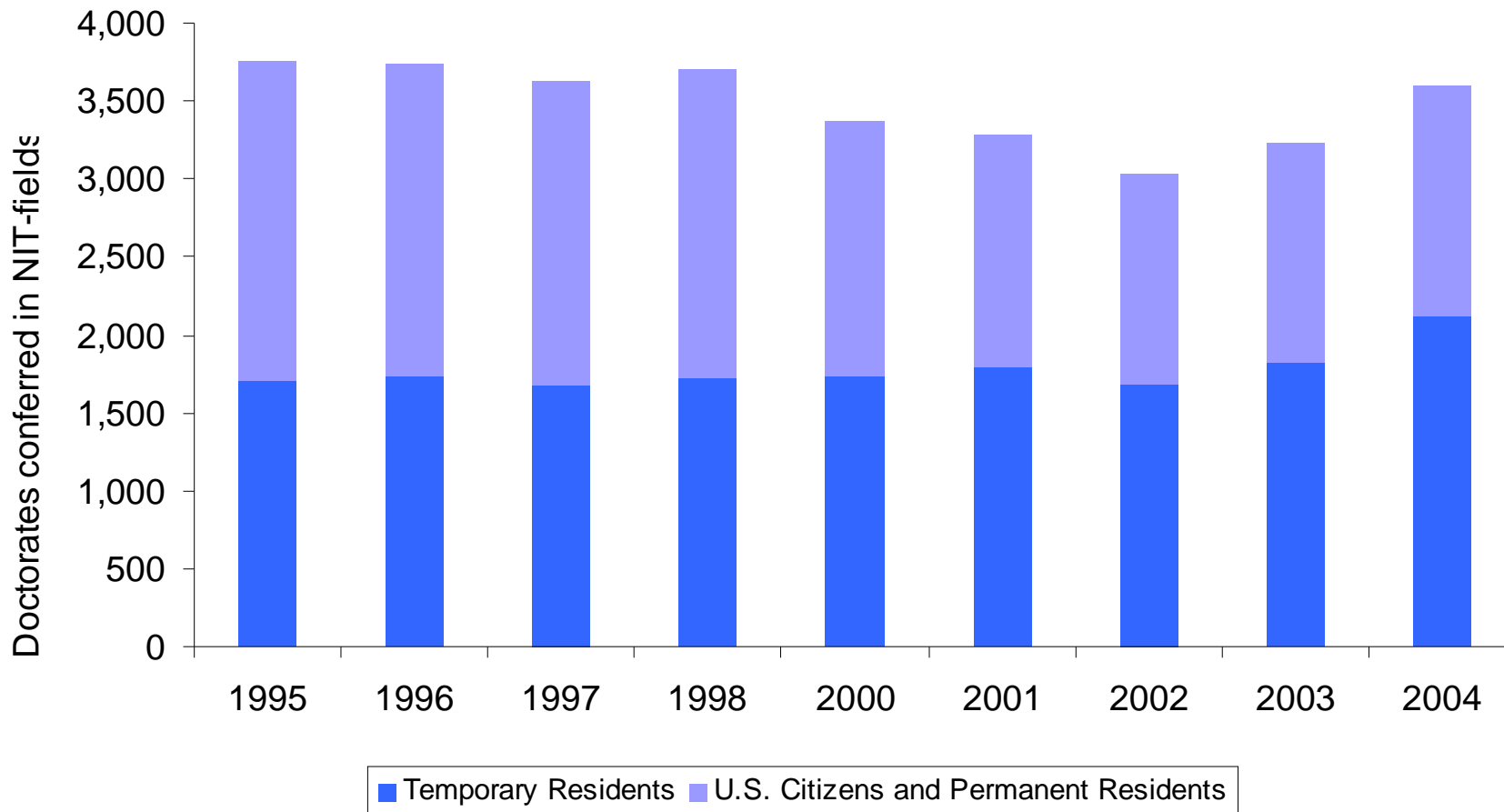
Education

In the United States, number of degrees granted in NIT fields has fluctuated

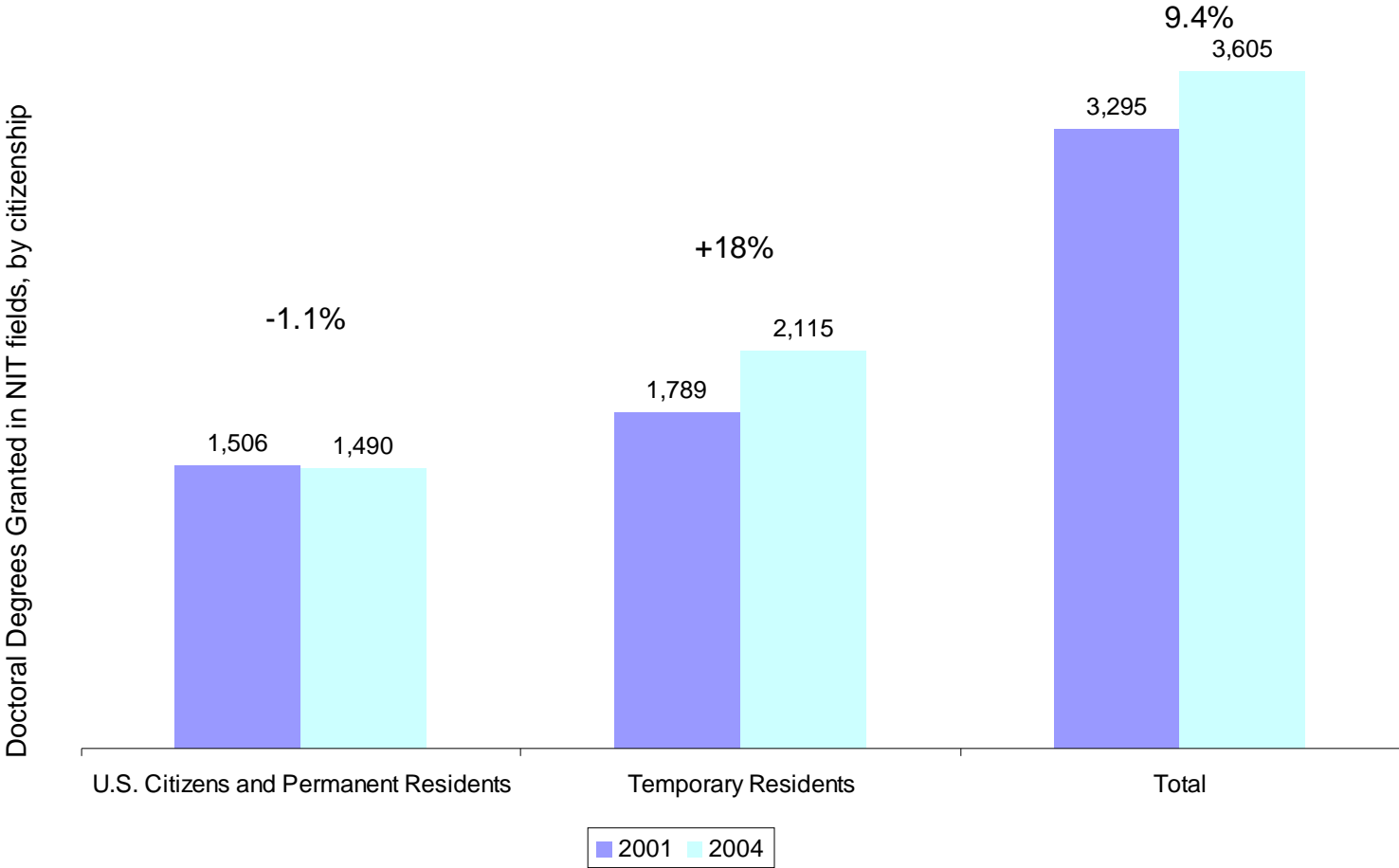


Source: IPEDS, WebCASPAR, IPEDS Survey by Race, 2006

Doctorates granted by U.S. institutions in NIT fields are fairly steady

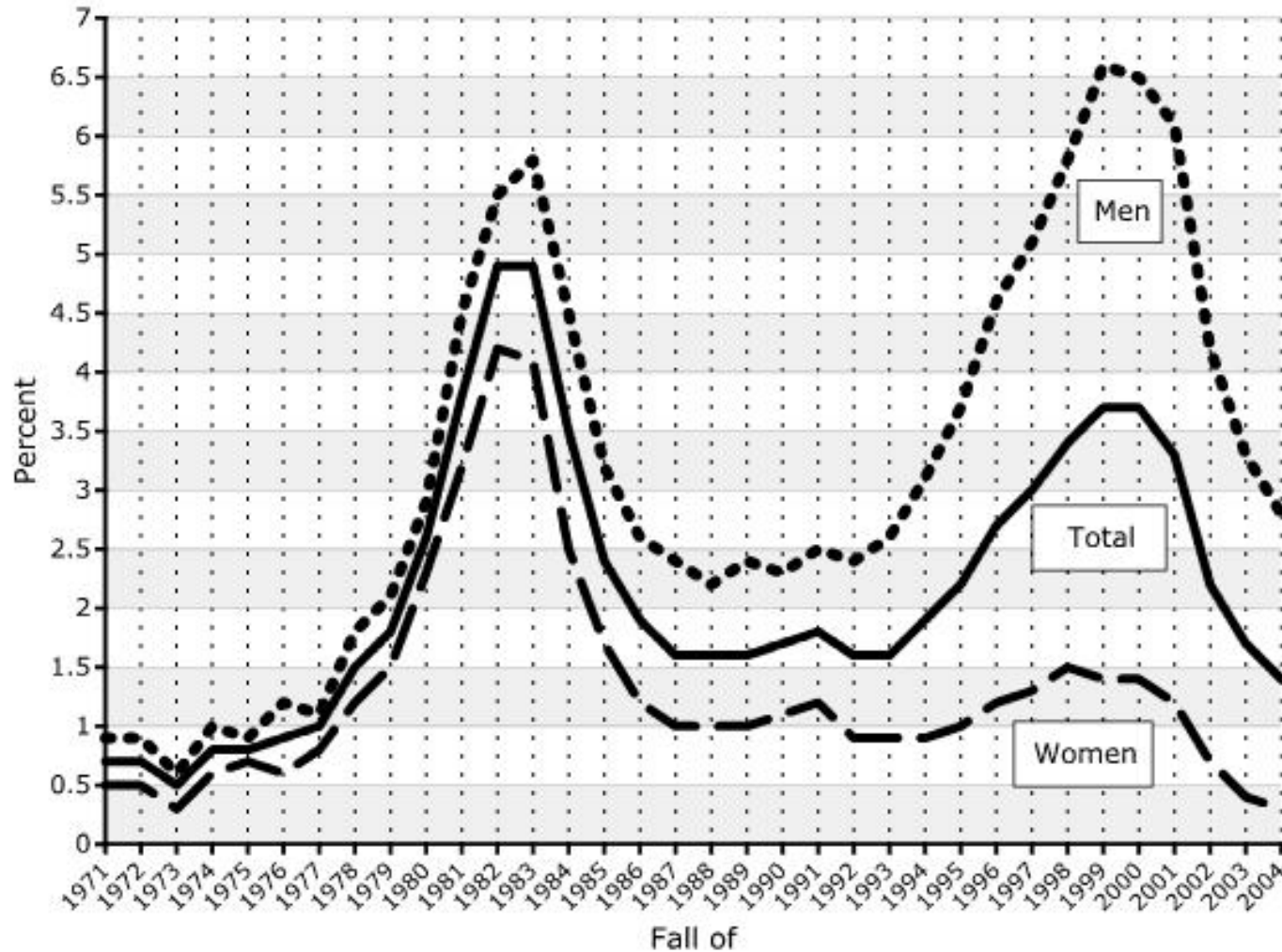


Degree increases at the doctoral level are entirely attributable to foreign students



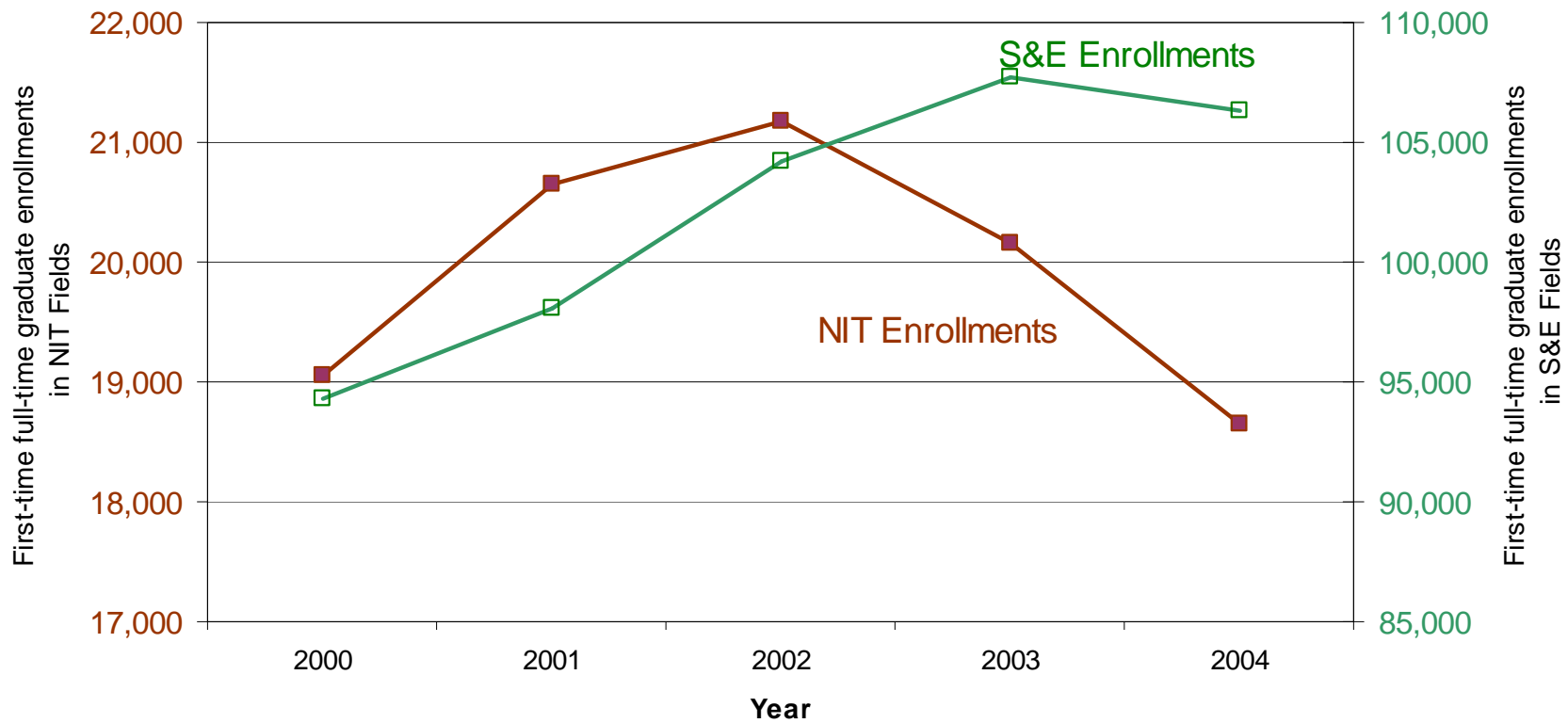
Source: IPEDS, WebCASPAR, IPEDS Survey by Race, 2006

In recent years, enrollments at the freshman level in computer science have been declining

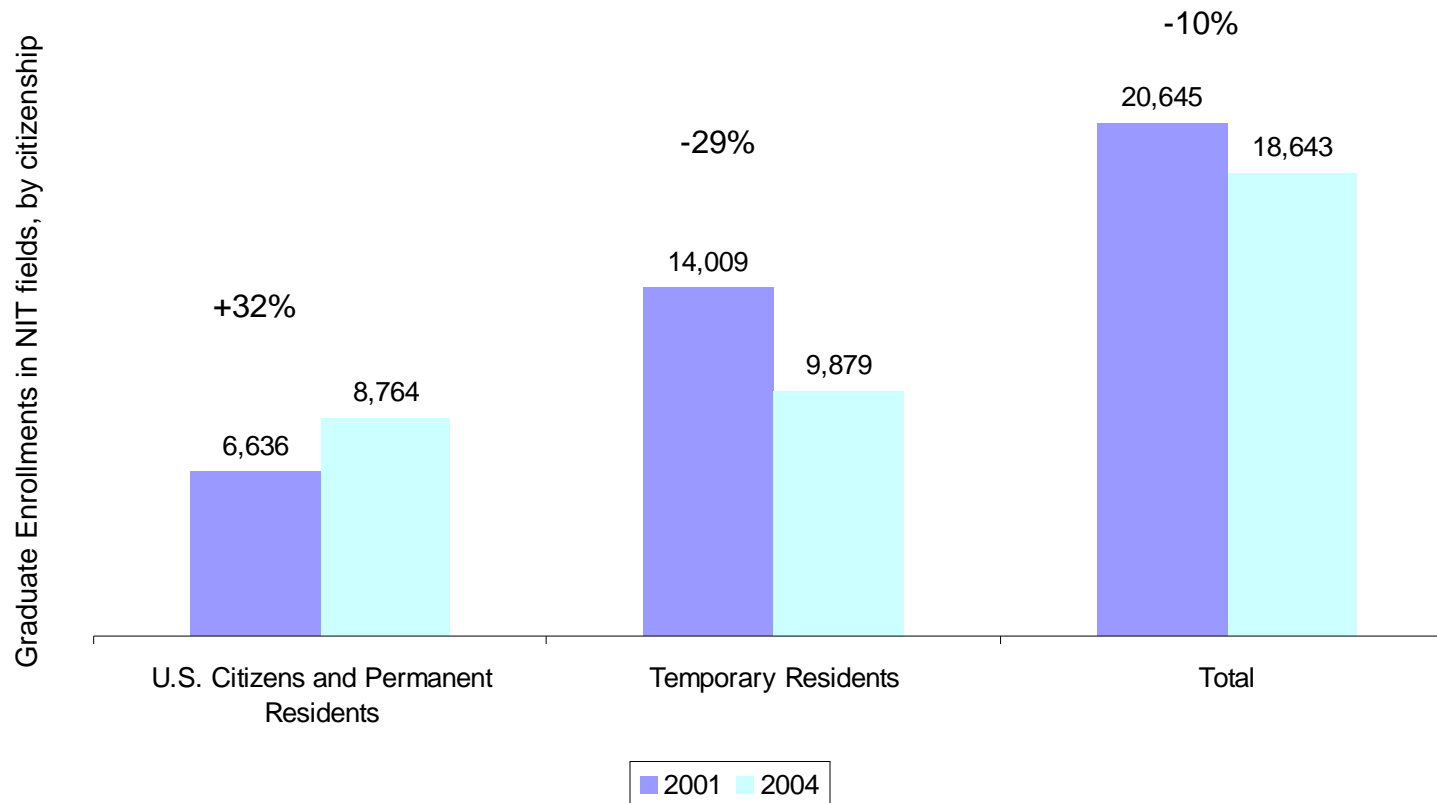


Source: Higher Education Research Institute at the University of California at Los Angeles (HERI/UCLA)

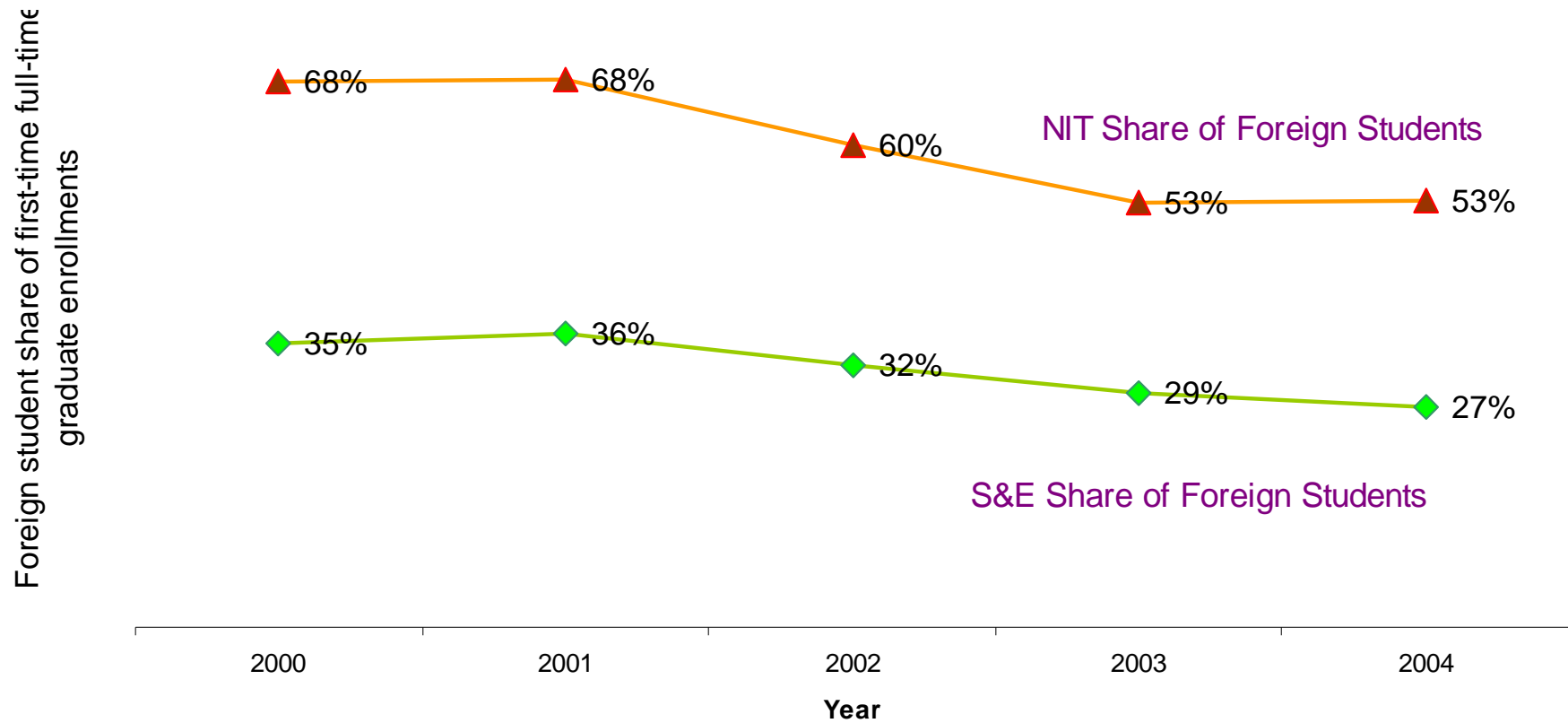
U.S. graduate student enrollments in NIT fields are declining as well



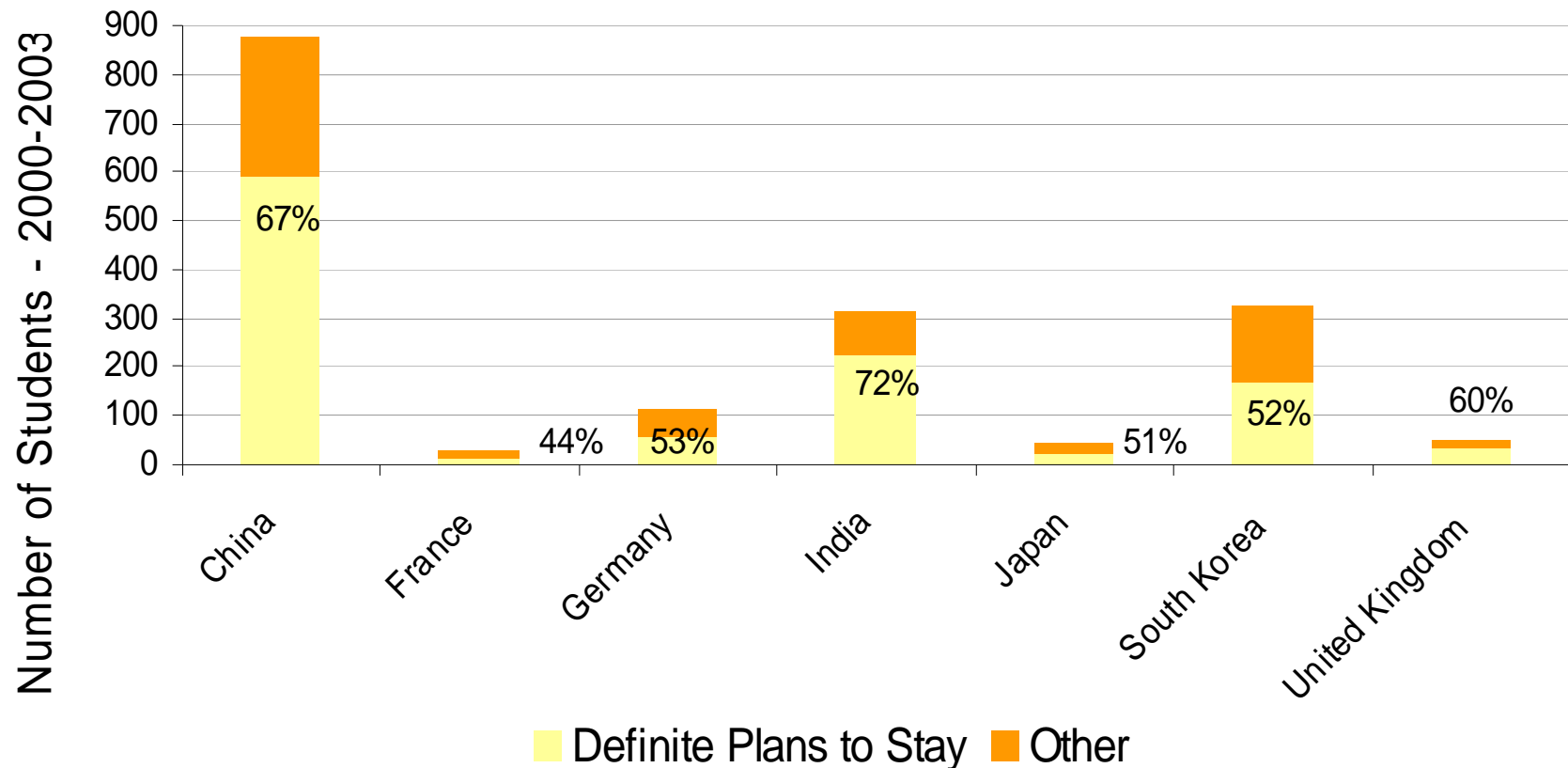
Enrollments at the graduate level declining because of decline of foreign student enrollment



NIT fields at the graduate level have a larger though declining share of enrolled foreign students



Until 2003, a large fraction of foreign doctorate recipients in math and computer science from U.S. institutions had definite plans to stay

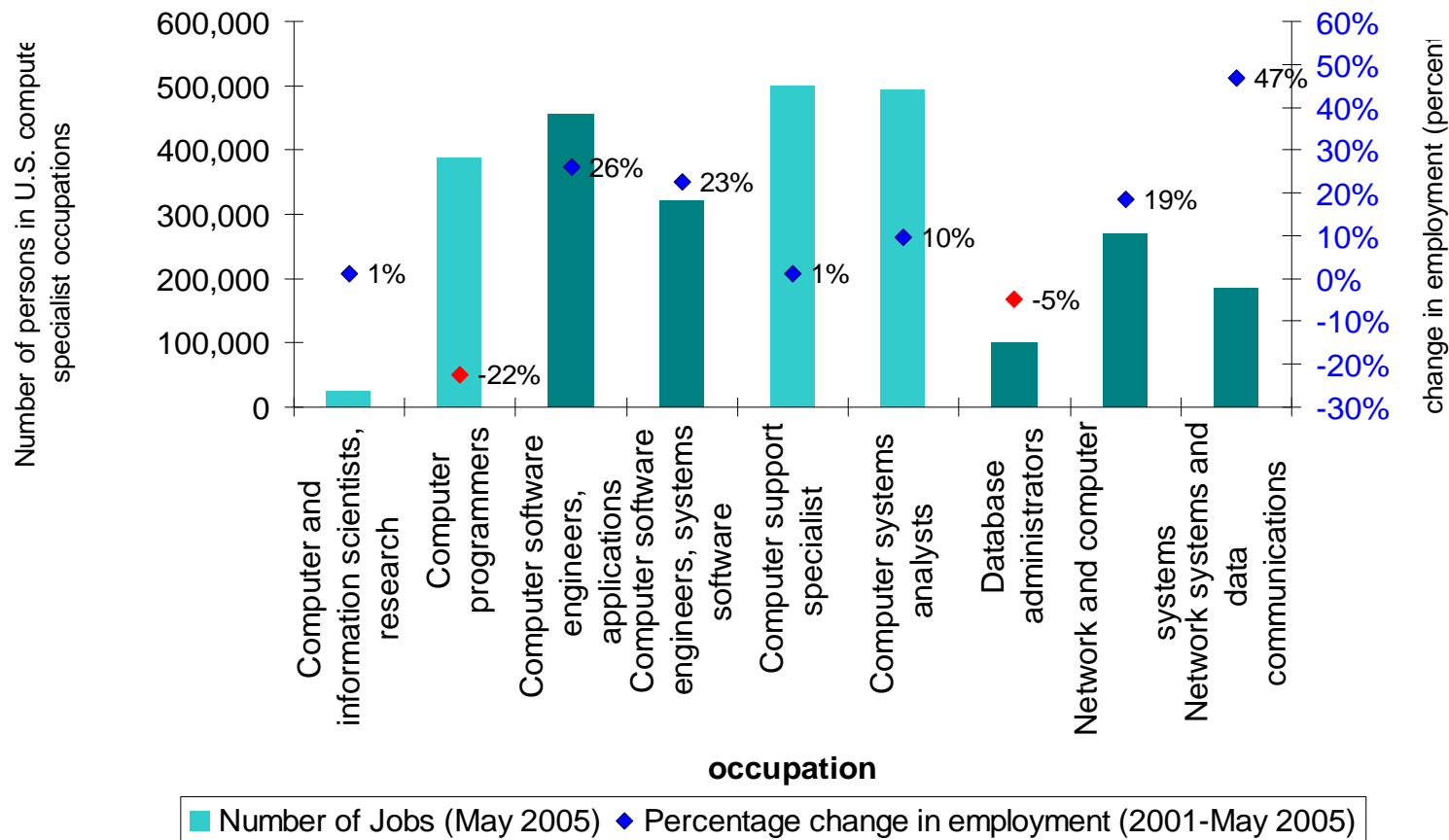


Notes:
 Data based on the NSF Division of Science Resource Statistics' Survey of Earned Doctorates, 2004. Surveyed individuals are "all individuals receiving a first research doctorate (second doctorates are not included) from a U.S. academic institution in the 12-month period ending on June 30, 2004." Surveys are given to graduates by their home university, which also collects them and submits them to NORC (survey contractor). Definite plans to stay defined as "returning to, or continuing in, predoctoral employment" or "have signed contract or made definite commitment for other work or study".

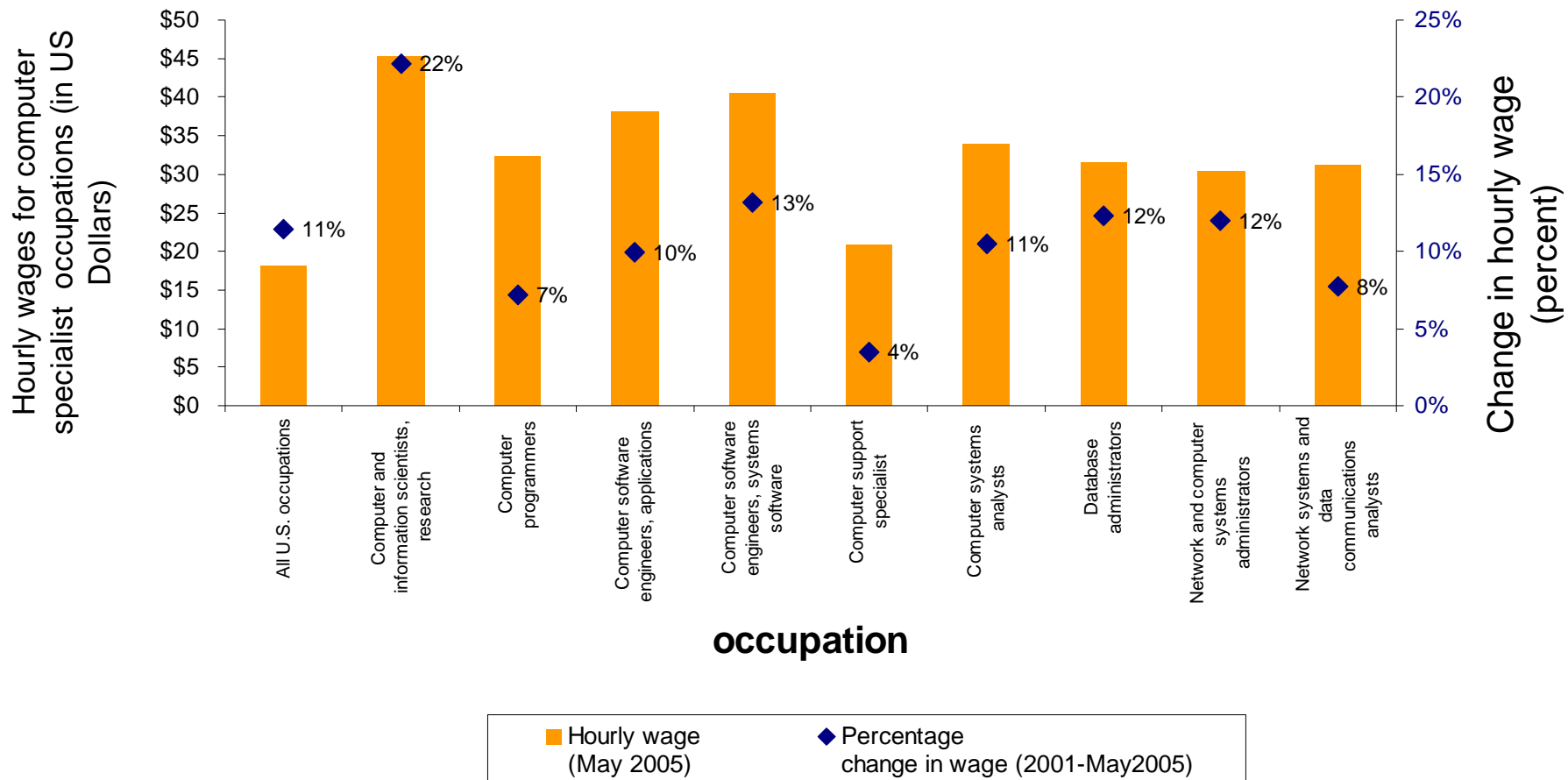
Source: NSF, *Science and Engineering Indicators*, 2006.

Workforce

Software and service-oriented NIT occupations have seen greatest employment growth



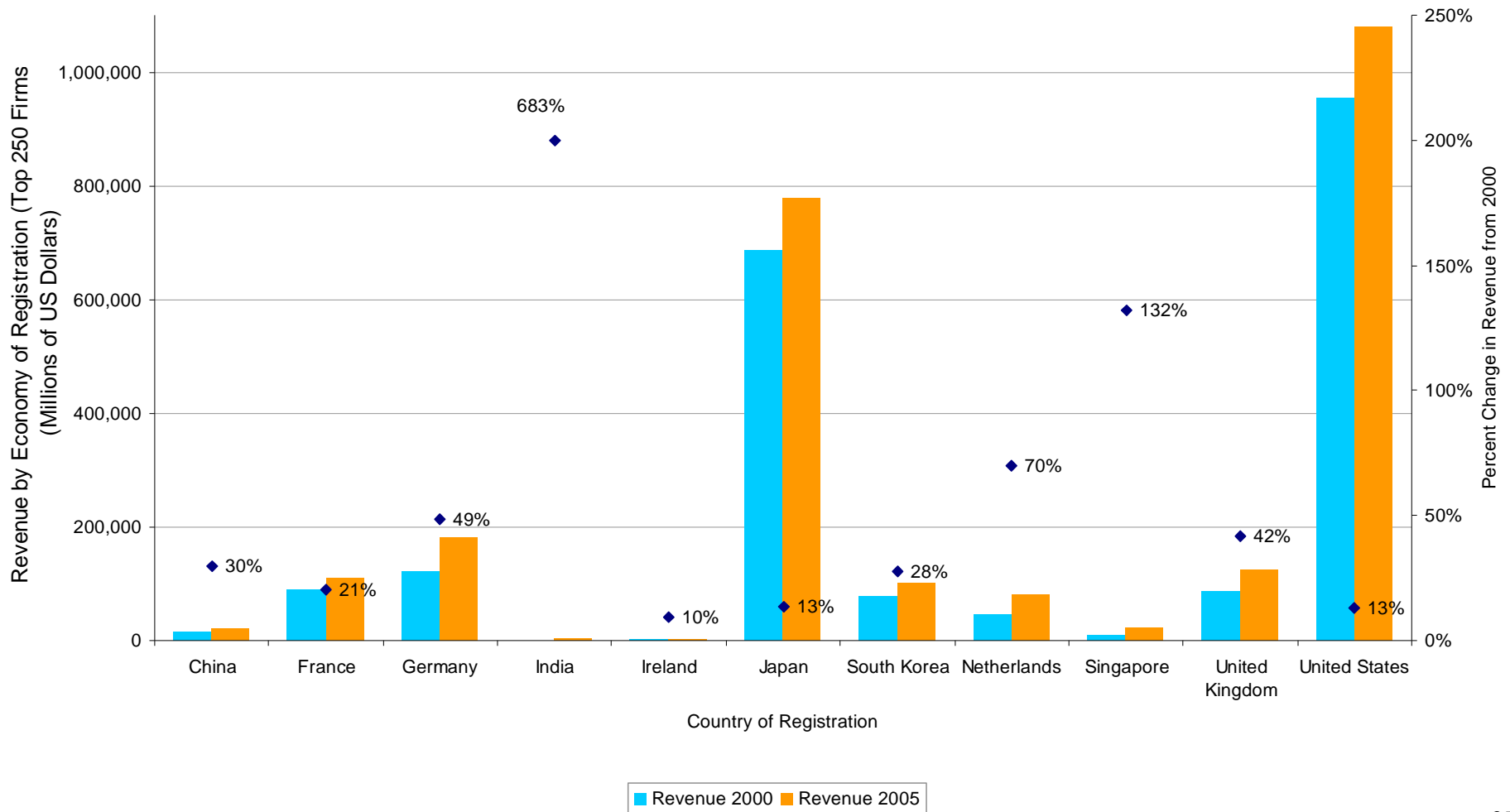
NIT occupations experienced slower wage growth compared to all U.S. occupations between 2001 and 2005



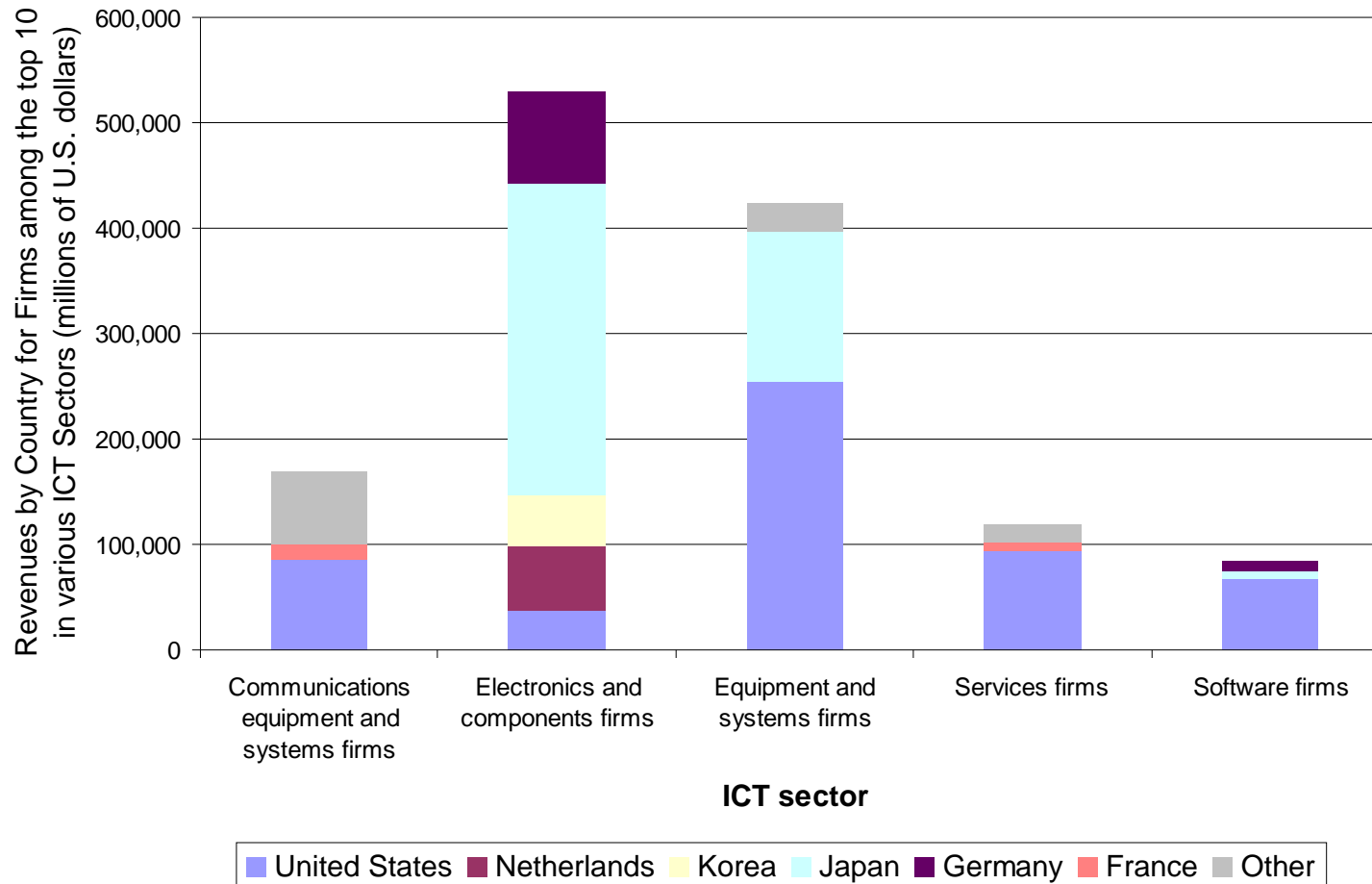
Source: Occupational Employment Statistics Survey (2005)

Firm Strength

Firms with United States and Japan as the home economies dominate top 250 ICT firms



Among top firms by sector, U.S. firms dominate services and software sectors



Looking to the Future



- **R&D.** R&D business investments in the U.S. higher than in most countries
 - *Are we getting a higher “bang for the buck?” Are we investing in the right areas?*
- **Venture capital.** Access in technology fields steady with an acceleration toward international investments
 - *Will VC’s increasing globalization dilute the US economic dynamic?*
- **Infrastructure.** U.S. lags behind other nations in consumer broadband access
 - *Will competitor nations leapfrog the U.S. with respect to new business models and technology innovations?*
- **Education.** Fewer students in the pipeline
 - *Will we have enough of a highly-skilled workforce to meet demand? Will the U.S. continue to attract the best and brightest students and workers from around the world?*
- **Firm strength.** U.S. firms dominate most sectors
 - *Are we losing our pre-eminence in potentially strategic sectors?*

Project Team



(in alphabetical order)

- John Bailey, Ph.D., Reviewer
- Allison Hodges
- Colleen Horin
- Bhavya Lal
- Jamie Link, Ph.D.
- Vivek Mohta, Ph.D.
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- Robert Winner, Ph.D., Consultant
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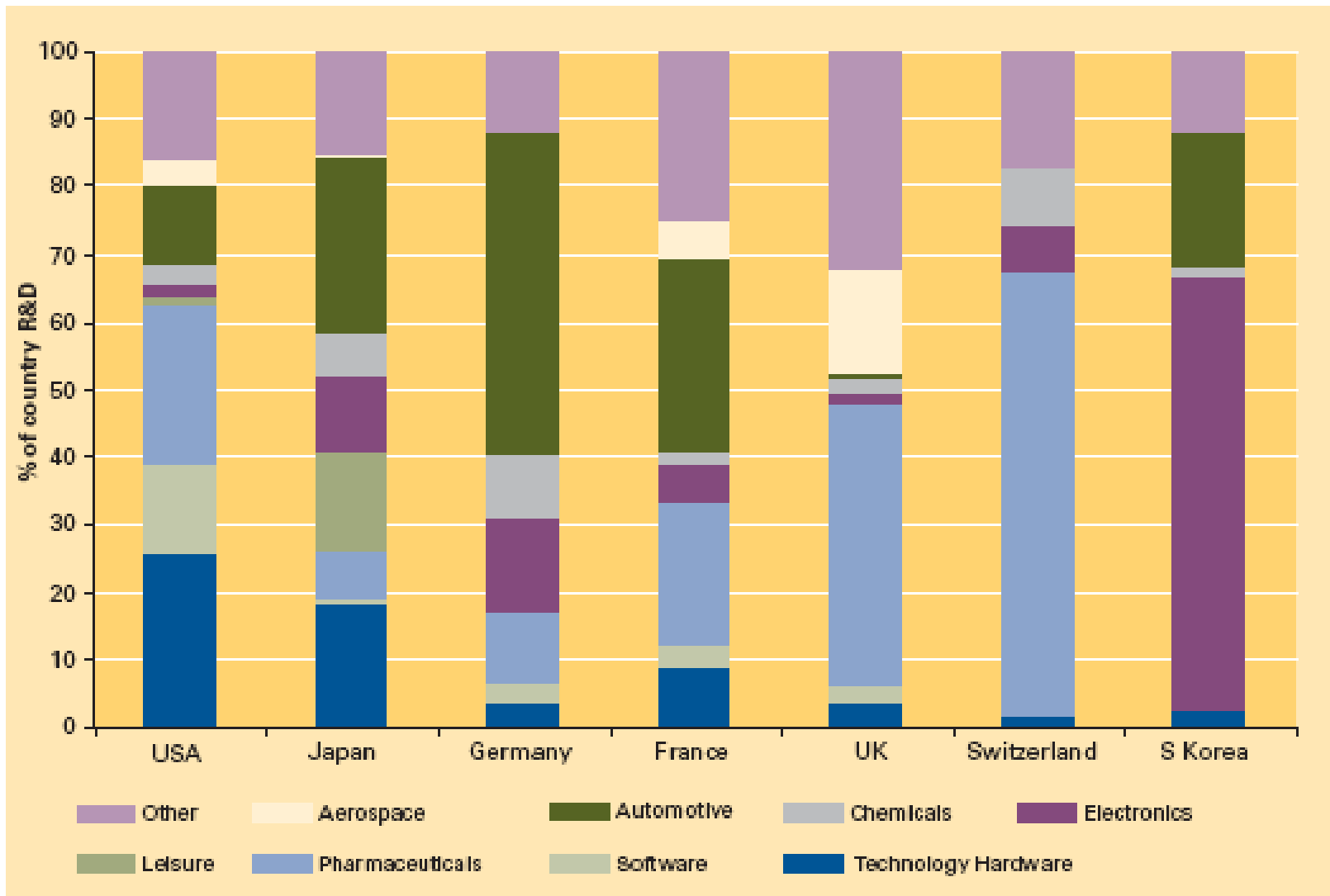


Feedback and Questions

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Some Backup Slides

R&D Expenditures by Sector – Firm-Level Aggregation



Source: UK Department of Trade and Industry R&D Scoreboard, 2006

Offshoring



Total U.S. software and NIT services spending offshore is increasing rapidly

- “Spending for global sourcing of computer software and services represented 2.3% of IT software and services spending by US corporations in 2003; expected to be 6.2% of the spending by 2008”^[2]

The value of IT offshoring and business process offshoring totaled \$34 billion in 2005^[3]

- “To date, the annual job loss attributable to offshoring is approximately 2 to 3 percent of the IT workforce. But this number is small compared with the much higher level of job loss and creation that occurs every year in the United States.”^[4]
- Growth not expected to reverse the large and growing trade surplus in software and services

While NIT service offshoring displaces some NIT workers, many experts believe there is a positive net impact on U.S. economic activity

Foreign Students and Professionals



Foreign Students in NIT

- The US has over half a million foreign students, over a quarter come from China and India alone. They form a miniscule fraction of the total student population of the United States. 12% are at the top 25 institutions.
- Four Asian nations comprise 45% of the foreign students in the US. Over the years, the percent of students that make up the foreign student pool in the US from China has decreased and of those from India has increased.
- US is the largest destination of students from Korea, Japan and India. Although it appears (at least in 2004), as many Chinese students head to Japan as to the United States.

Immigrants in the NIT workforce are important as well – more so than many other fields.

- Immigrants have started a larger percent of firms in the ICT industry than in most other sectors
- 24 percent of venture-backed U.S. public companies in the ICT industry were founded by immigrants (40 percent in high tech manufacturing industry)
 - Temporary residents have started 25 percent of all venture-backed public U.S. firms
 - These firms have a market capitalization of over \$500 billion, and employ over 220,000 U.S.
 - (as comparison, legal immigrants comprise less than 9% of the population of the US)
 - legal immigrants comprise less than 9% of the population of the US
- Leading home countries of founders were India, Israel, and Taiwan
- The worker distinction is intimately linked with students
 - One quarter of all temporary work visas are converted from student visas
 - Half of permanent visas come from adjustment of temporary visas