

NATIONAL SCIENCE BOARD BRIEFING ON



THE STATE OF U.S. SCIENCE

FEB. 23, 2018 10:45 AM – 12:00 PM
COUNCIL ON GOVERNMENTAL RELATIONS

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*NSB Vice Chair / Senior Advisor to the Provost & Prof. of Computer Science & Math
Tufts University*

Beethika Khan

NSF Program Director for SEI program, NCSES/SBE



Speakers:

Dr. Diane Souvaine

Vice Chair, National Science Board
Senior Advisor to the Provost and Professor of
Computer Science and Mathematics, Tufts University

Dr. Beethika Khan

Director, Science and Engineering Indicators Program
The National Center for Science and Engineering Statistics

Dr. Carol Robbins

Senior Analyst, Science and Engineering Indicators Program
The National Center for Science and Engineering Statistics





National Science Board

Founded in 1950 as part of NSF Act

24 Members + NSF Director

Policy making body for NSF

- Develops a long-term vision for NSF
- Establishes NSF policies
- Identifies issues that are critical to NSF's mission

Serves as a body of advisors to both the President and Congress on broad, national policy issues related to science and engineering





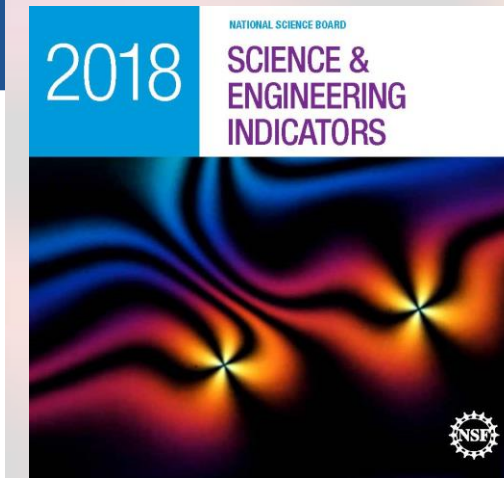
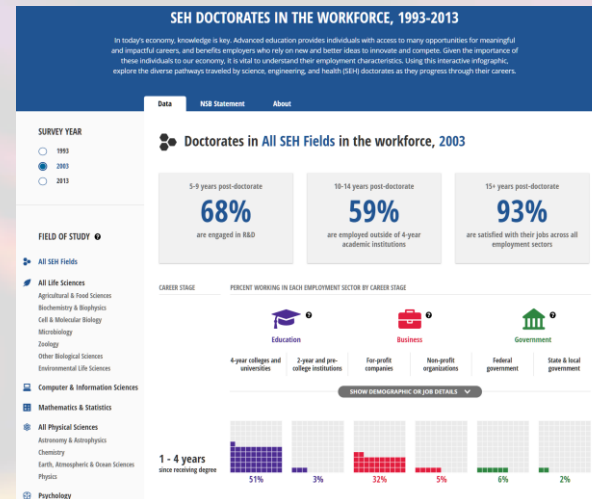
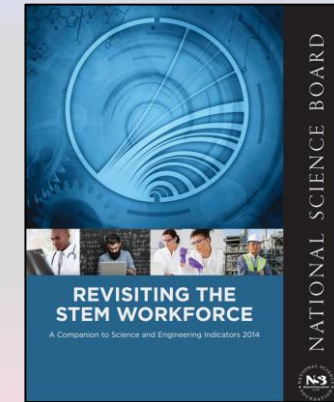
Science & Engineering Indicators

2018

- ❖ Biennial report on the state of S&E in the U.S.
- ❖ Required by law; delivered to the President and Congress
- ❖ Factual and policy neutral
- ❖ Drawn from a wide variety of high quality data sources



Indicators Suite of Products



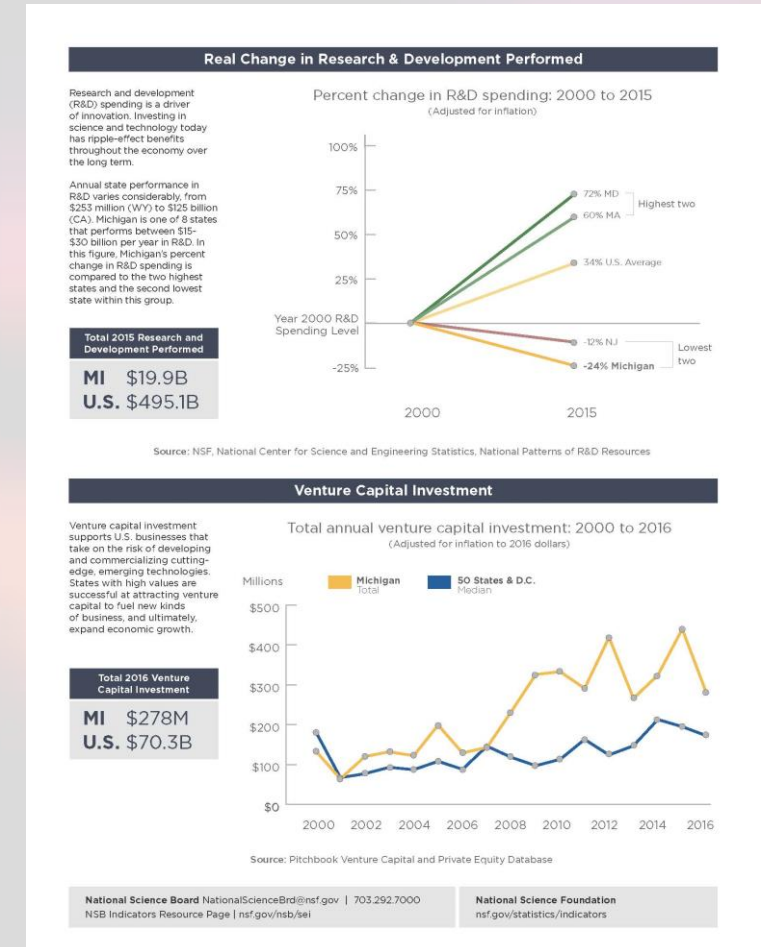
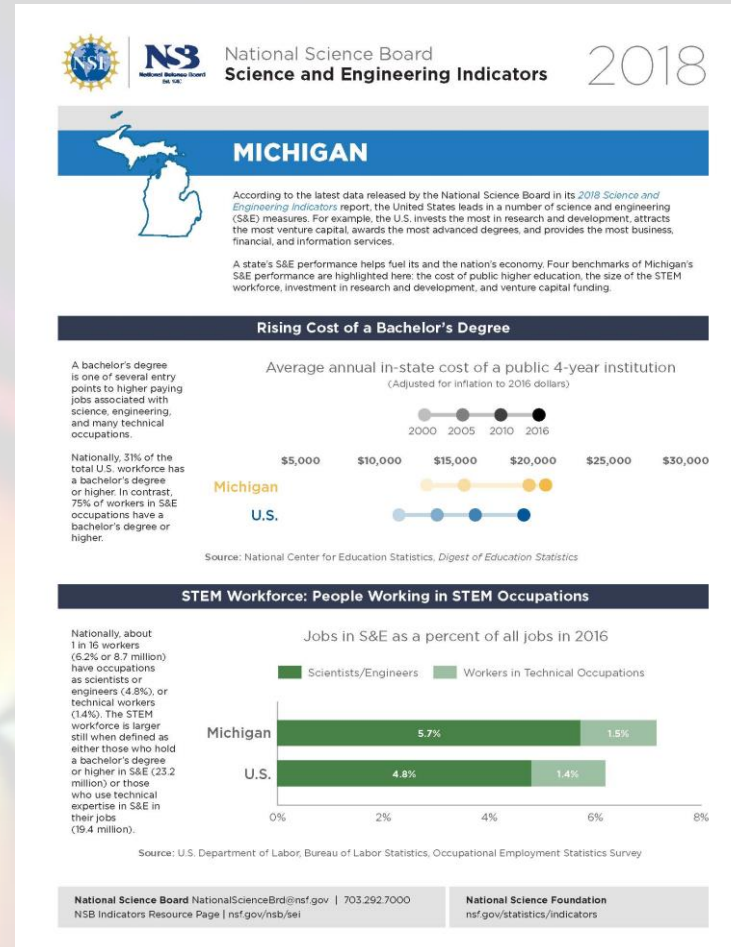
- **Eight chapters:** education, workforce, R&D, academic R&D, publications, production and trade, public attitudes and understanding, and **innovation**.
- **Overview, Digest, State Data Tool, NSB Policy Companion reports**



State data sheets

Four benchmarks of S&E performance:

1. Cost of a Bachelor's Degree at a public institution
2. Percentage of people working in STEM jobs
3. Change in R&D spending, 2000-2015
4. Venture capital investment



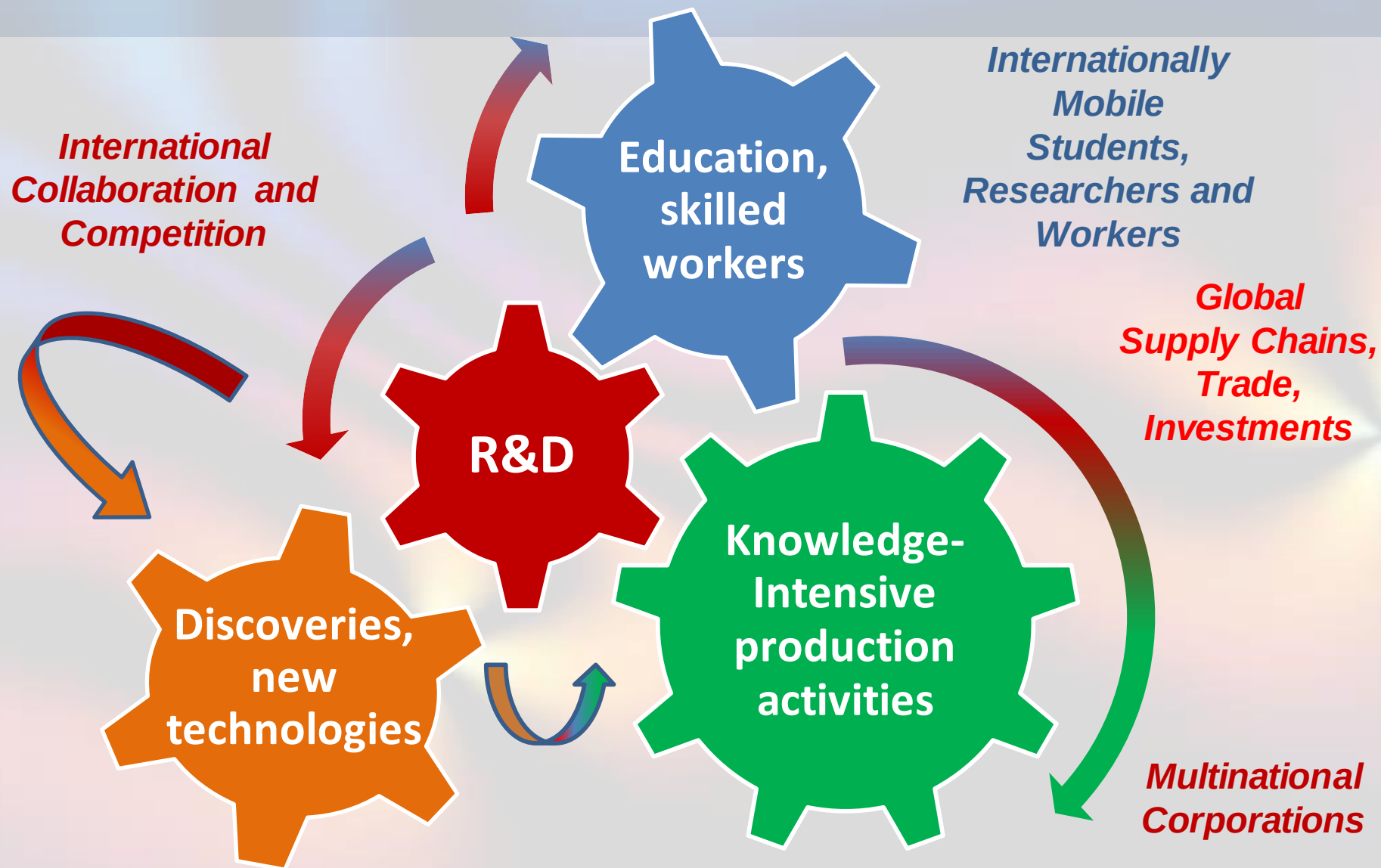
Central Theme

Worldwide trend toward knowledge- and technology-driven economies; capacity building in S&E

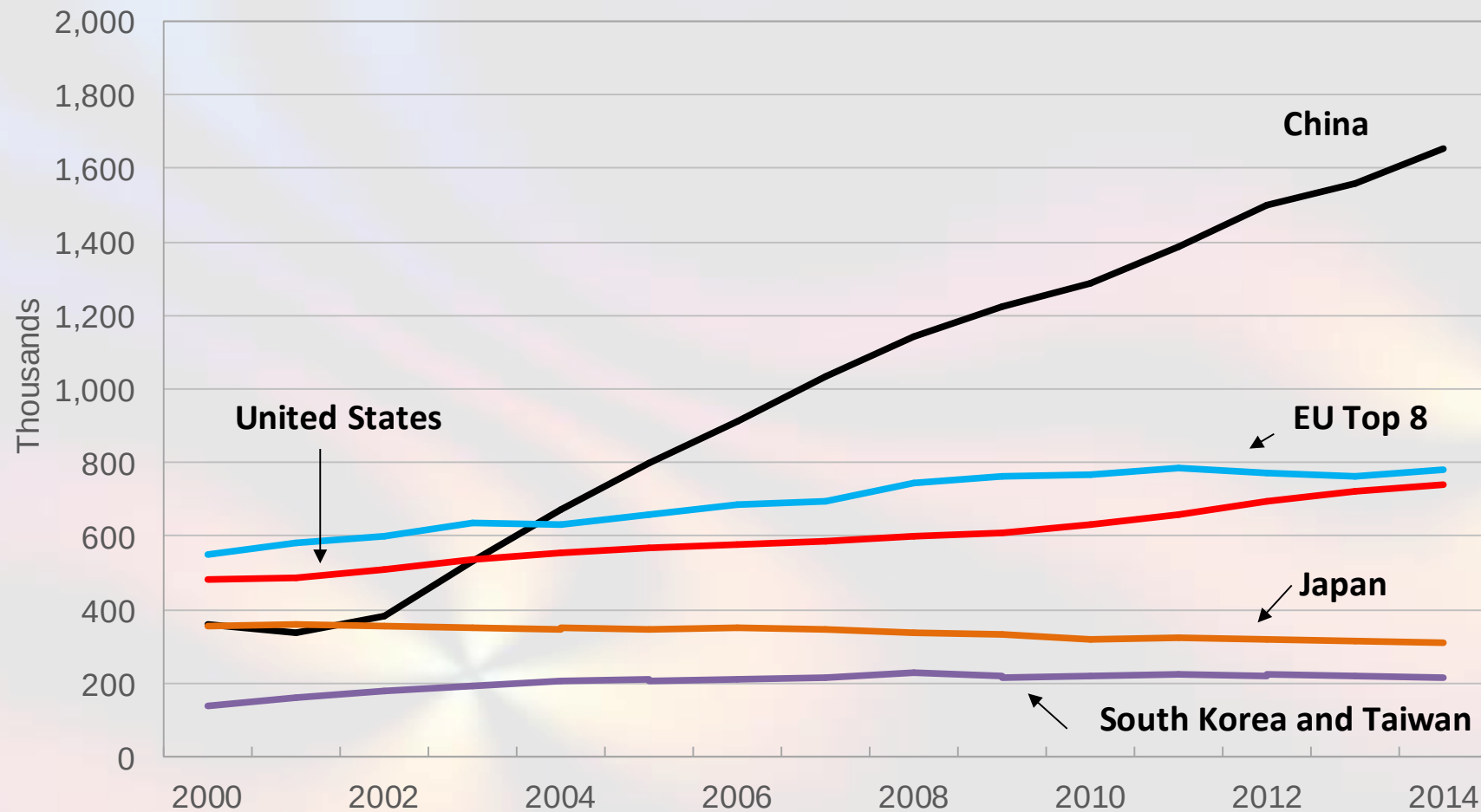
A multipolar world for S&E is emerging



Global Context



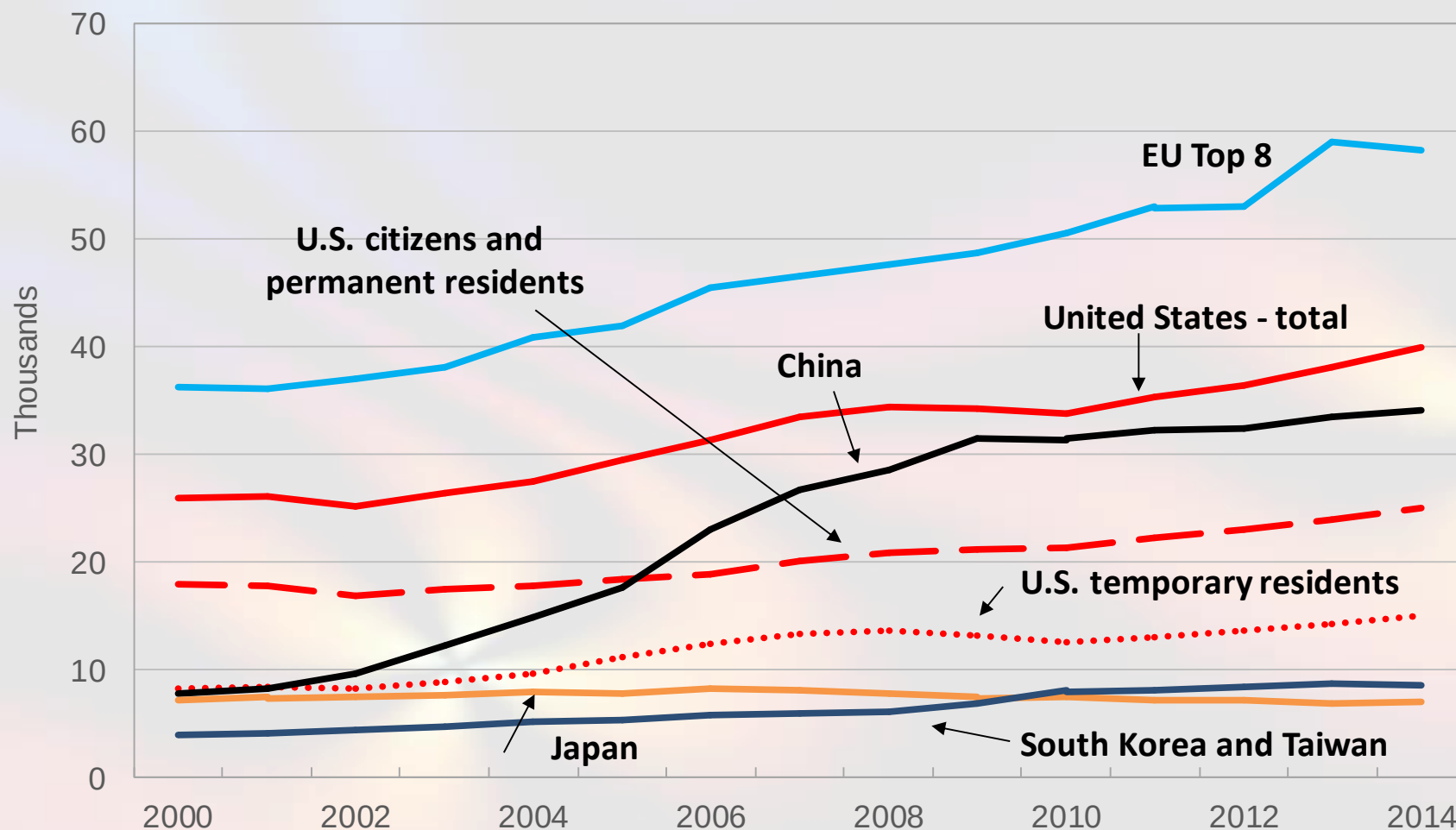
S&E Bachelor's Degree Awards: 2000-14



EU Top 8: United Kingdom, Germany, France, Poland, Italy, Spain, Romania and Netherlands.



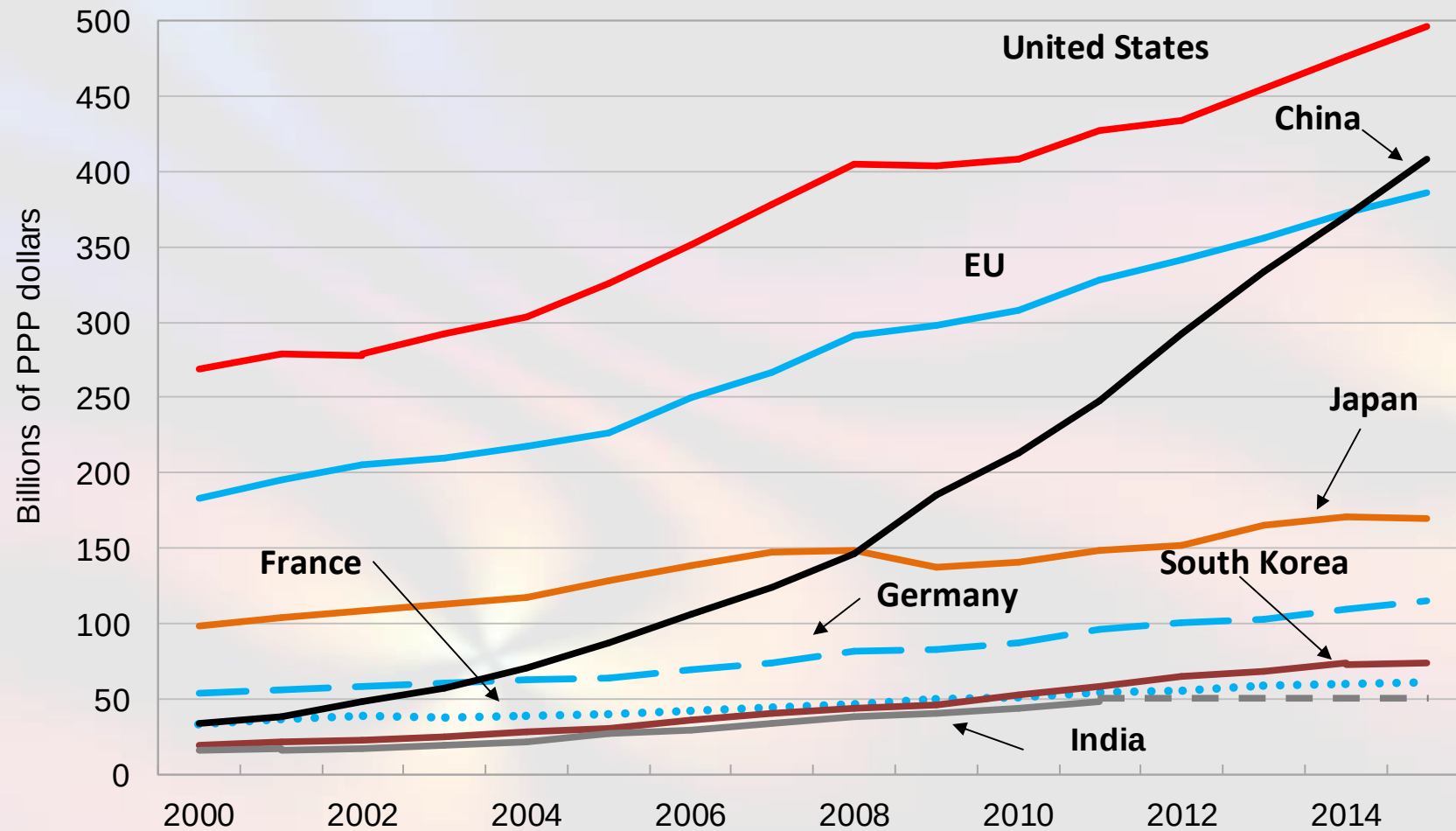
S&E Doctoral Degree Awards: 2000-14



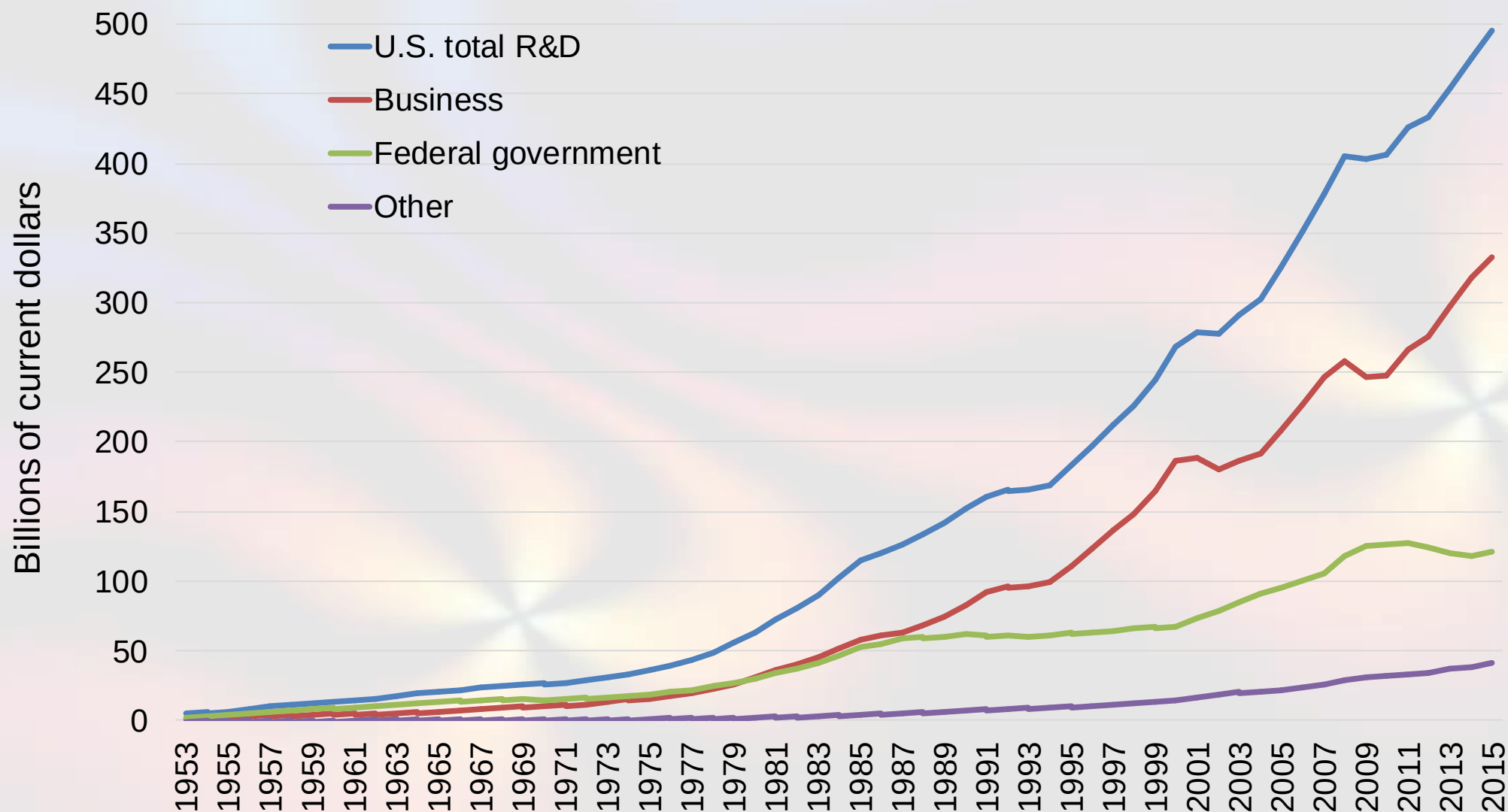
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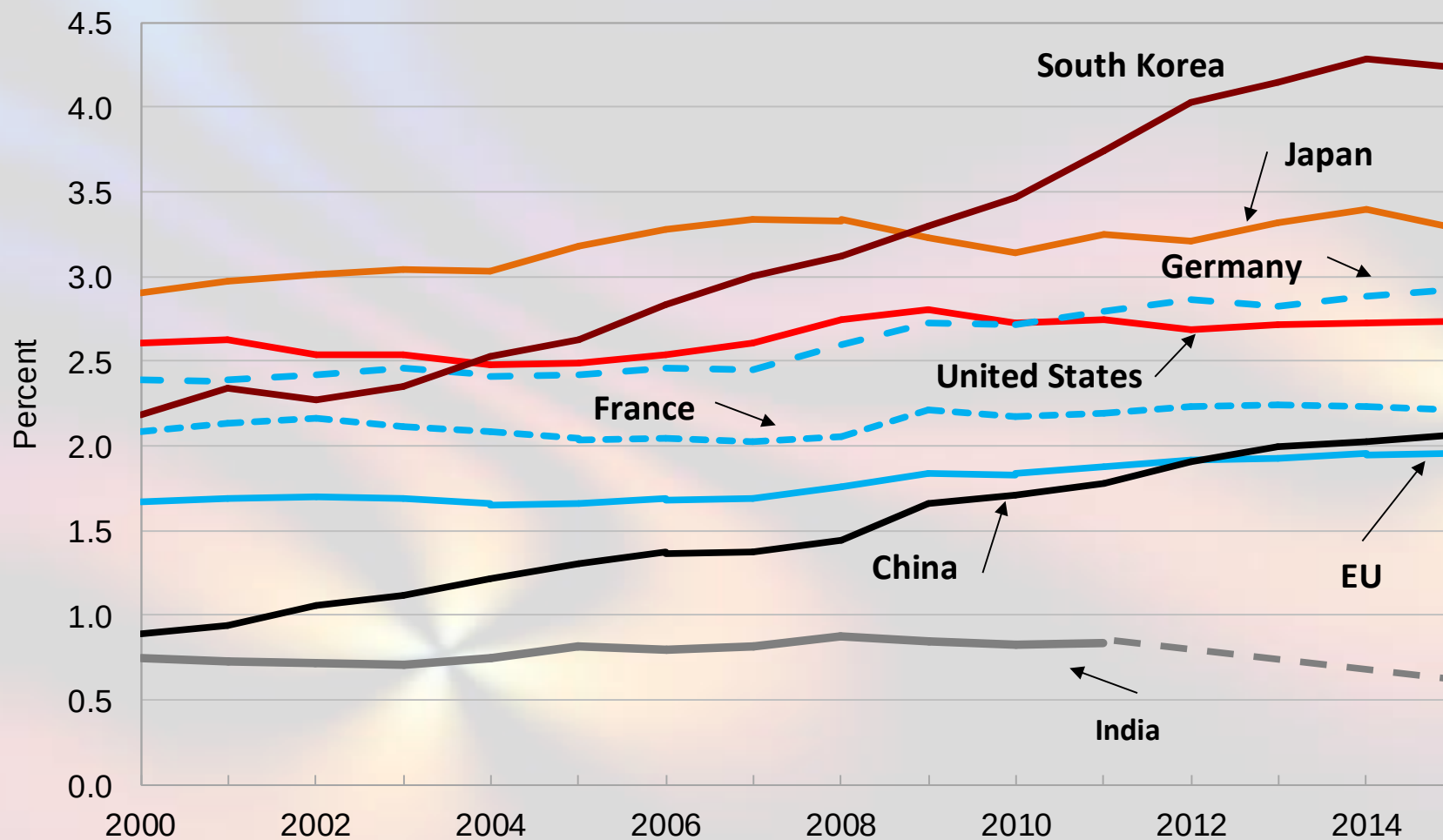
R&D expenditures: 2000–15



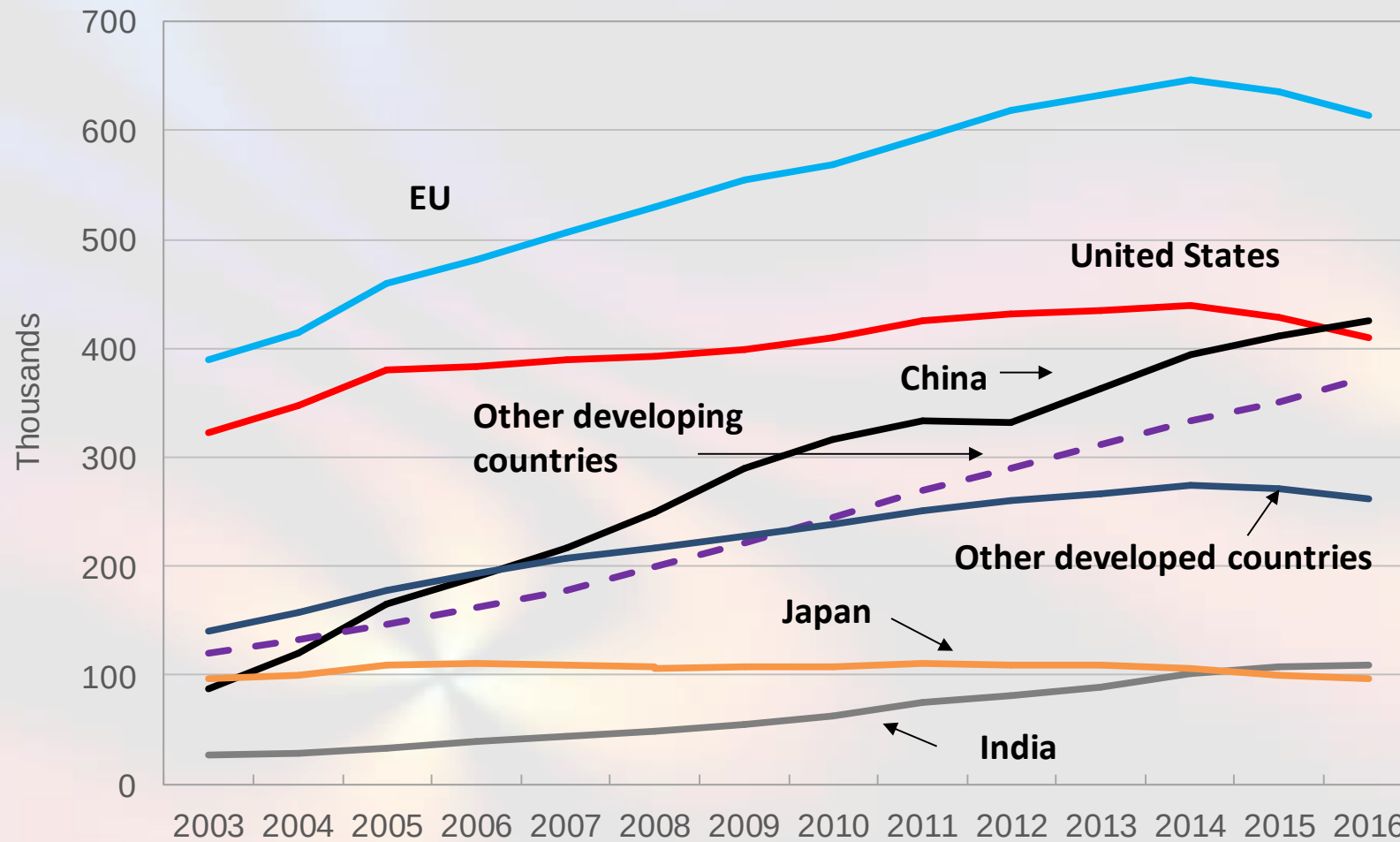
U.S. R&D source of funds: 1953–2015



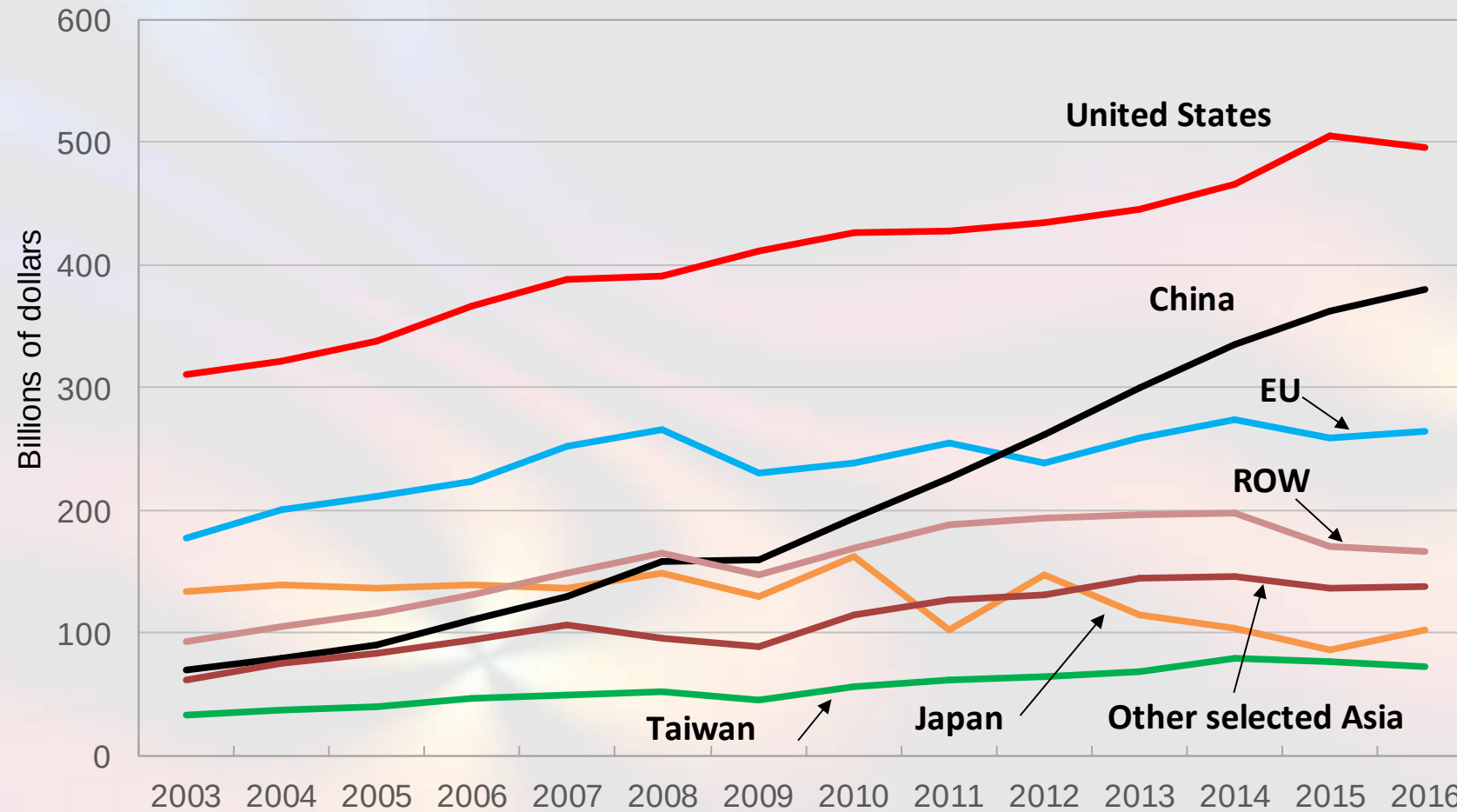
R&D Intensity (R&D/GDP): 2000–15



Peer-reviewed S&E publications: 2003–16



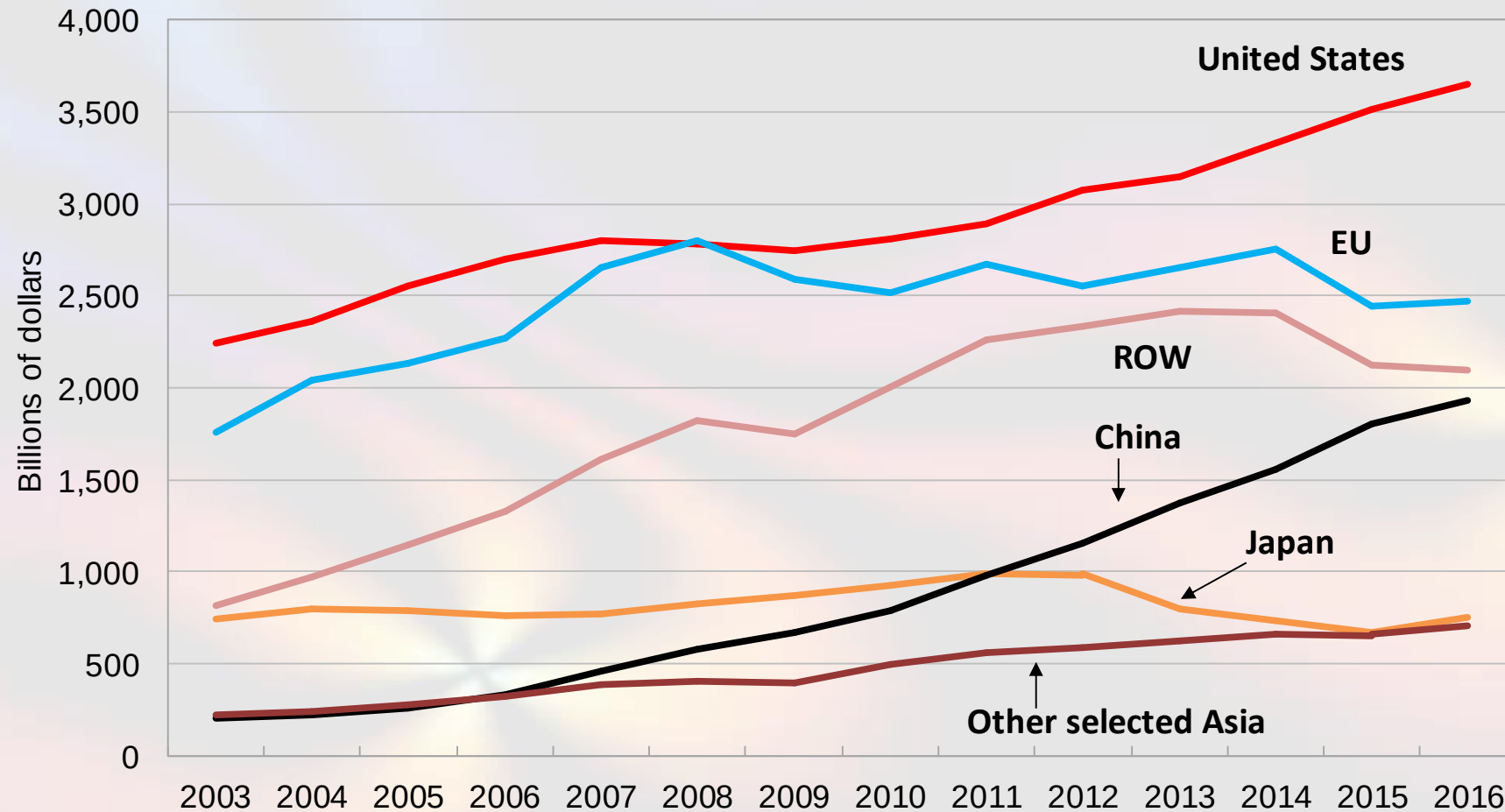
Value-added output of HT manufacturing industries 2003–16



Other selected Asia: India, Indonesia, Malaysia, Philippines, Singapore, South Korea, and Vietnam.
ROW: Rest of the world.



Value-added output of commercial knowledge-intensive services industries: 2003–16



Other selected Asia: India, Indonesia, Malaysia, Philippines, Singapore, South Korea, Taiwan, and Vietnam.
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Summary: *How are we doing?*

- **Shift in global S&E landscape**
 - Historically centered around U.S., Western Europe, Japan
 - China emerging as a major player
- **U.S. still leads in**
 - R&D and high-impact publications
 - Intellectual property
 - Knowledge-intensive production activities
- **Likely overall direction of global S&T landscape**
 - dynamic, fast changing, integrated, interactive, competitive, multipolar.



Innovation Takes Place Within an Interconnected System

Multiple Indicators

- ❖ Invention

- ❖ Knowledge Transfer

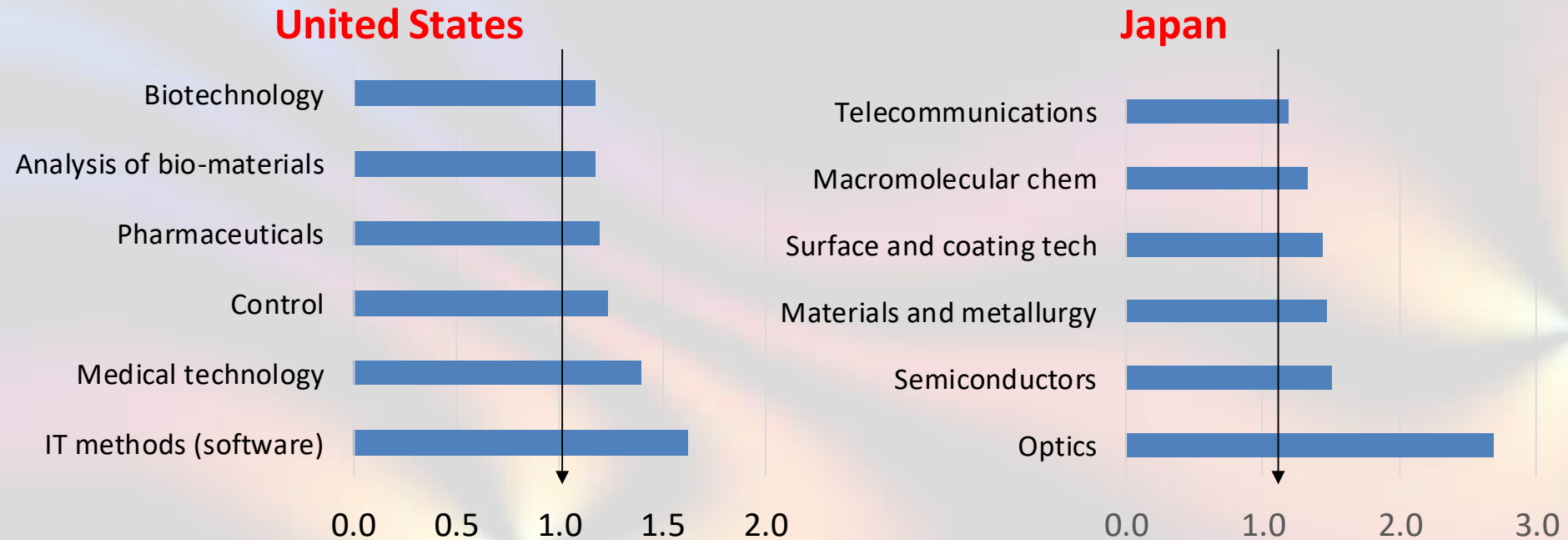
- ❖ Innovation

 - Investment in Intangibles

 - Share of US Firms introducing innovations



Patent Specialization for the US and Japan: 2014–16



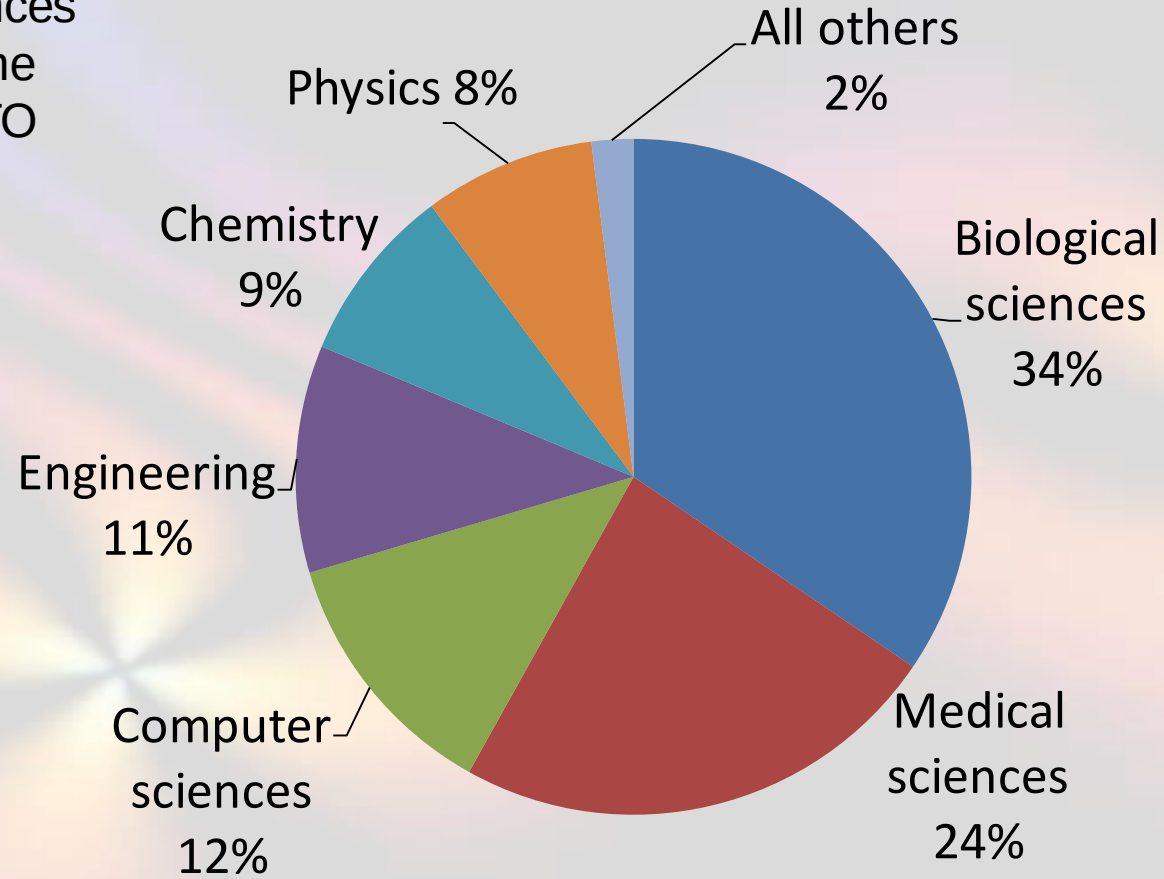
IT = information technology.

NOTES: A patent activity index is the ratio of a country's share of a technology area to its share of all patents. A patent activity index greater (less) than 1.0 indicates that the country is relatively more (less) active in the technology area.



Knowledge Flows from Research into Patented Technology

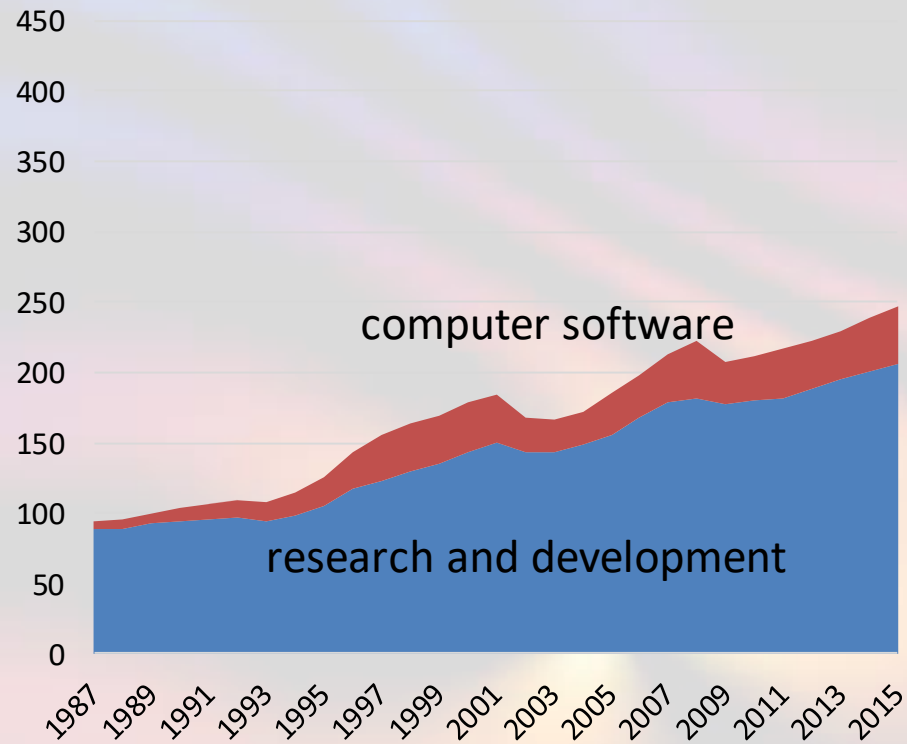
S&E articles in biological sciences medical sciences received over half of the citations to 2016 USPTO patents that cite US authors.



Investment in Intangibles Contributes to Innovation

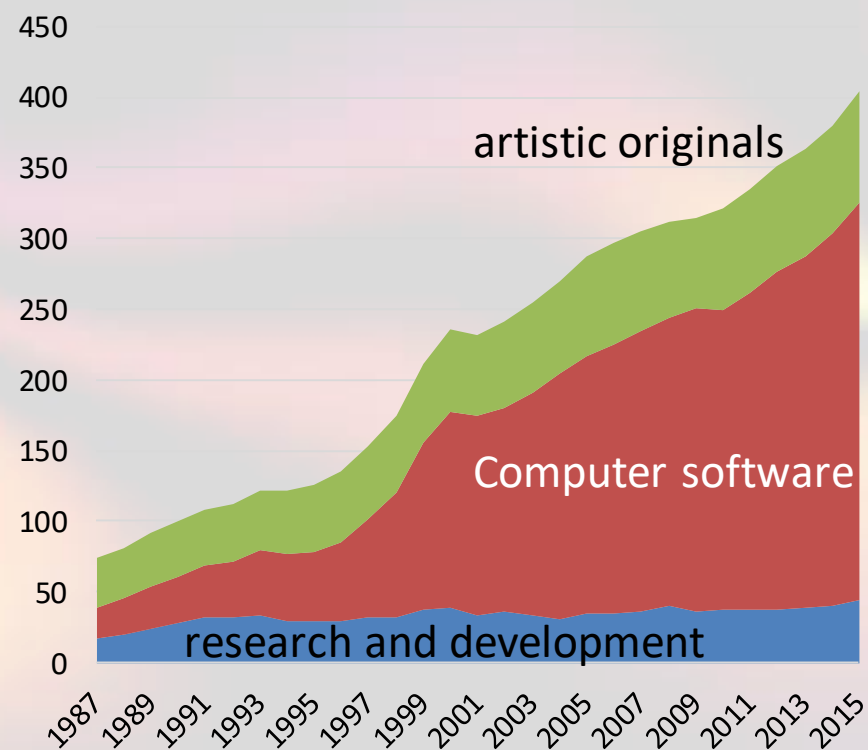
Manufacturing

billions of constant dollars



Nonmanufacturing

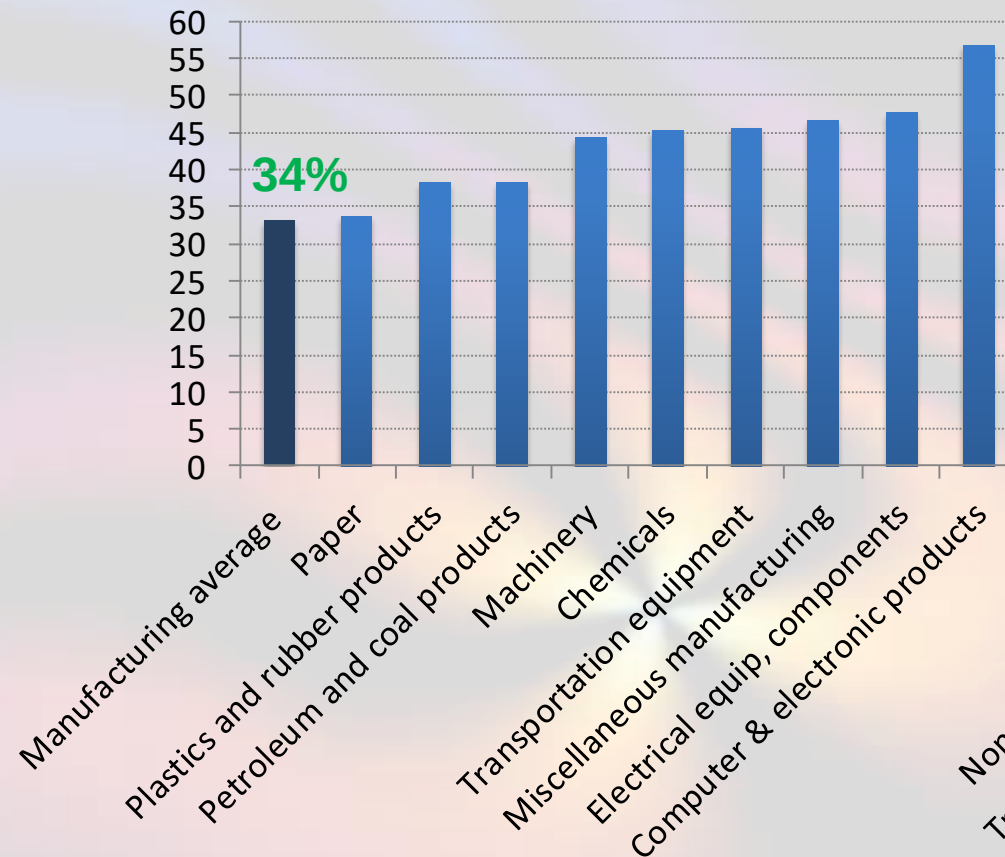
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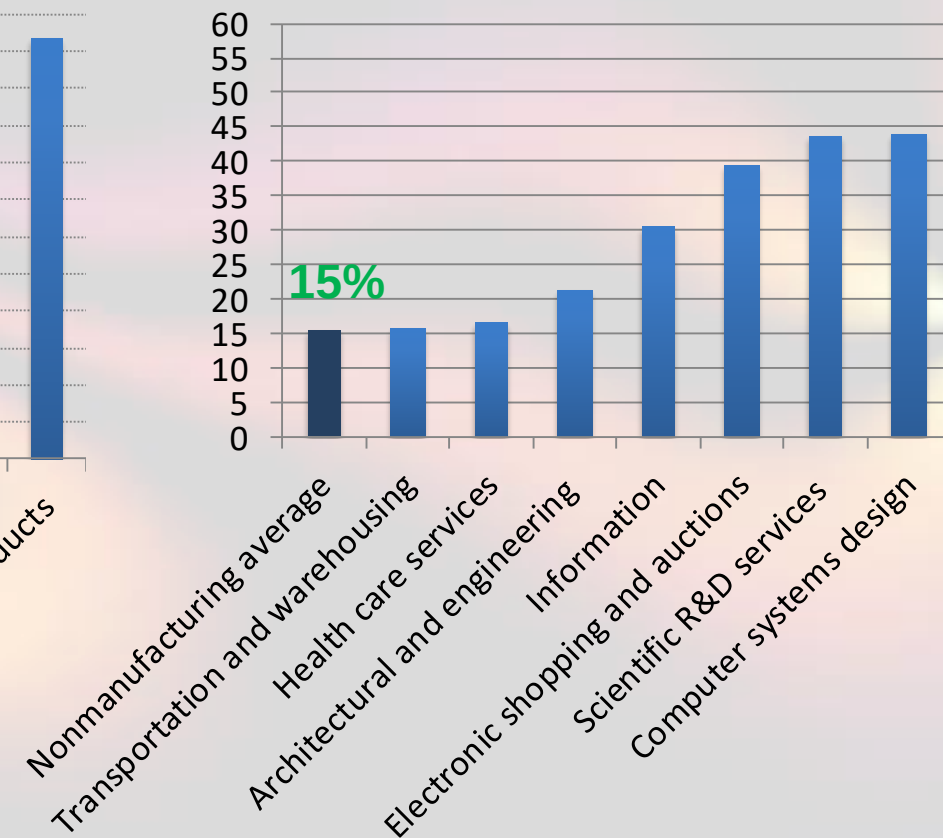
One in Six US Firms Report Innovation

17% of U.S. firms reported introducing a new product or process during 2013–15

Manufacturing firms 113,000



Nonmanufacturing firms 1.3 million



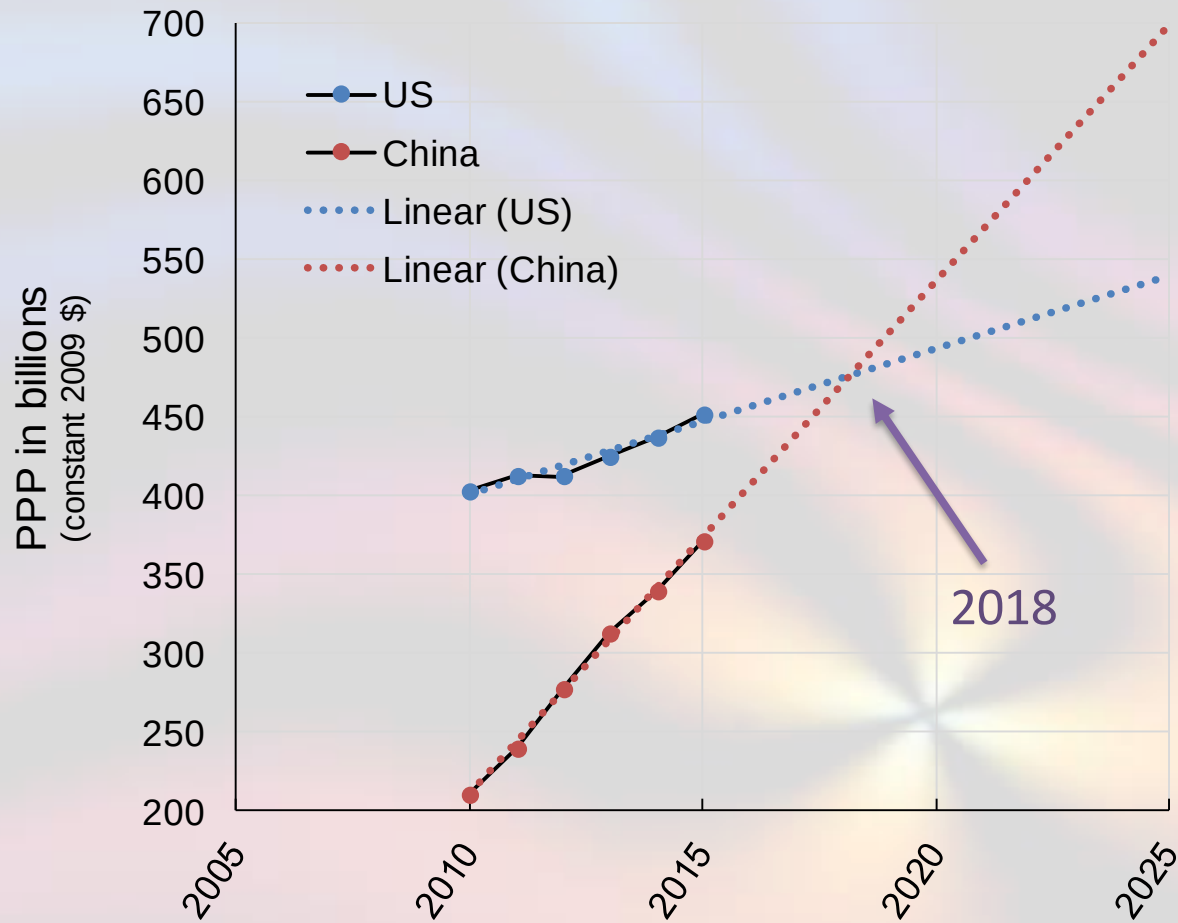


Reflections on the 2018 Report

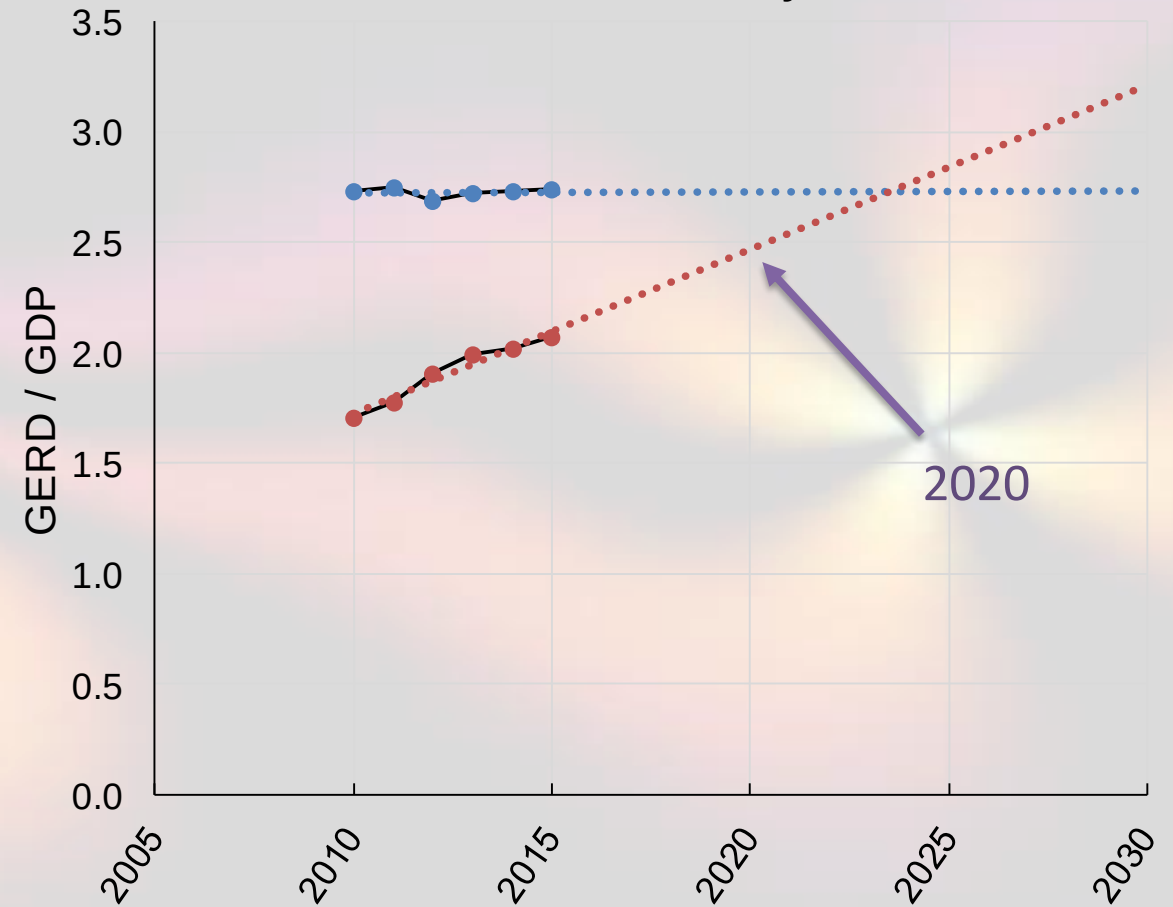


What might the future hold?

Gross Expenditures on R&D



R&D Intensity



How can we compete?

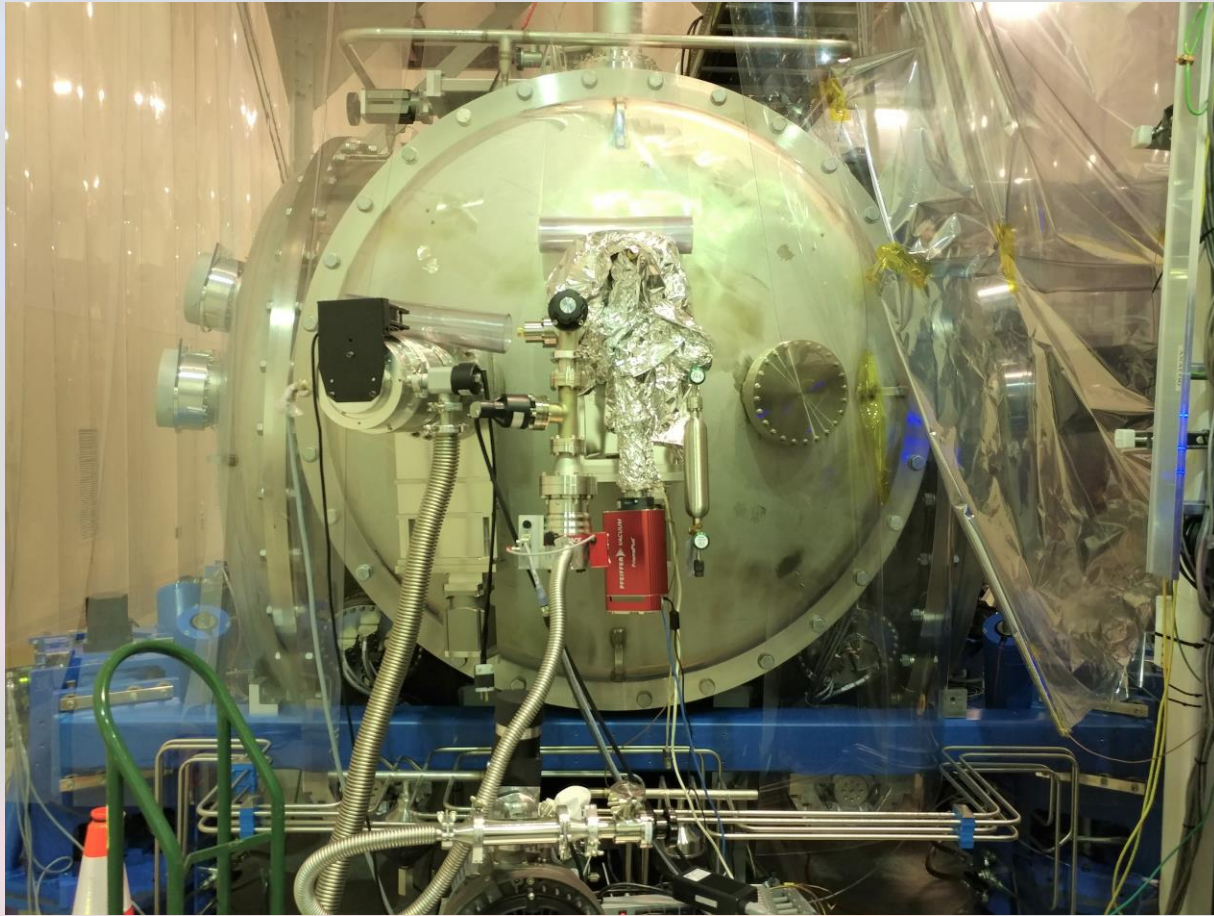


A STEM-capable U.S. Workforce

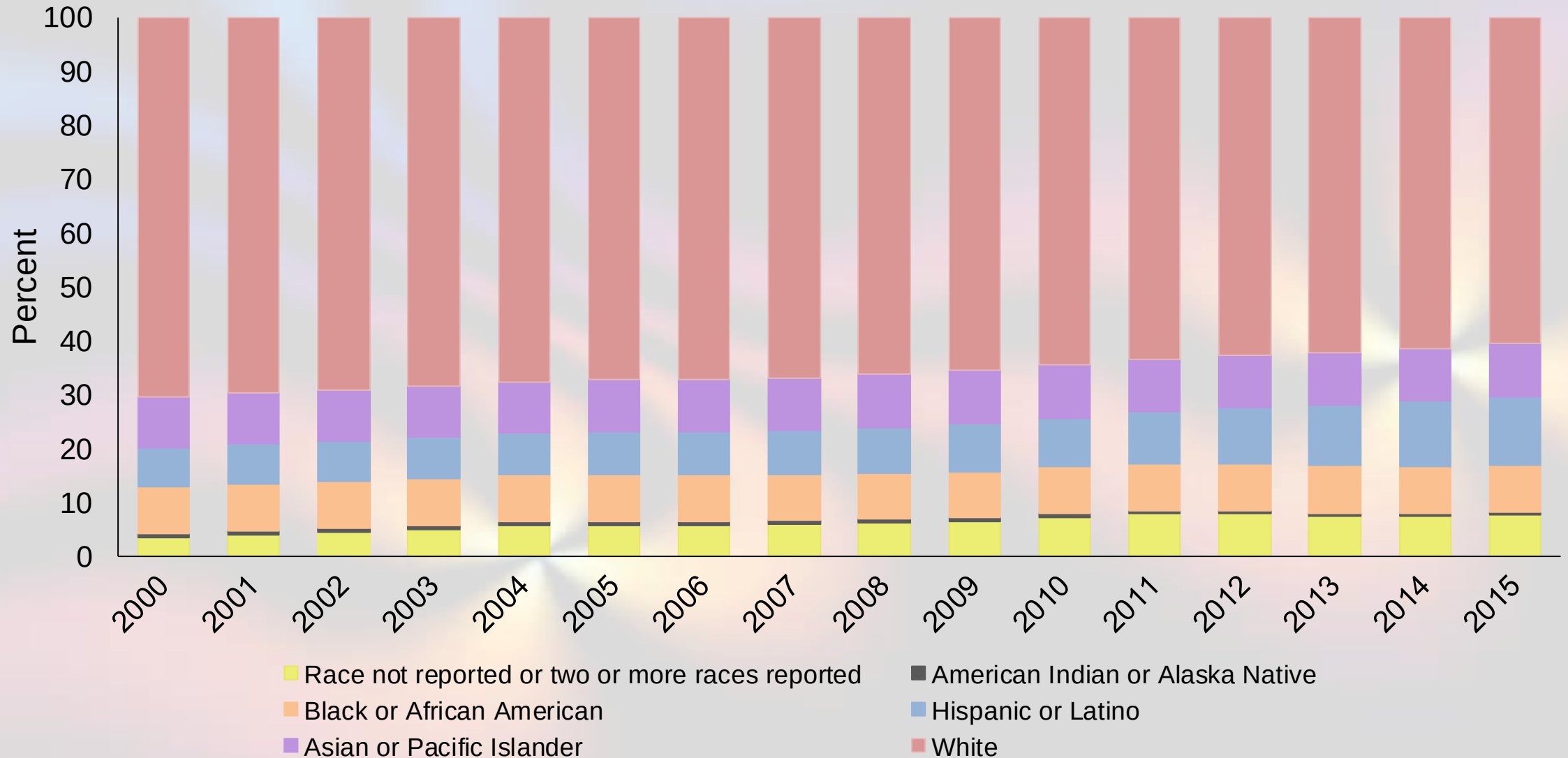
A Policy Companion Statement to Indicators 2018



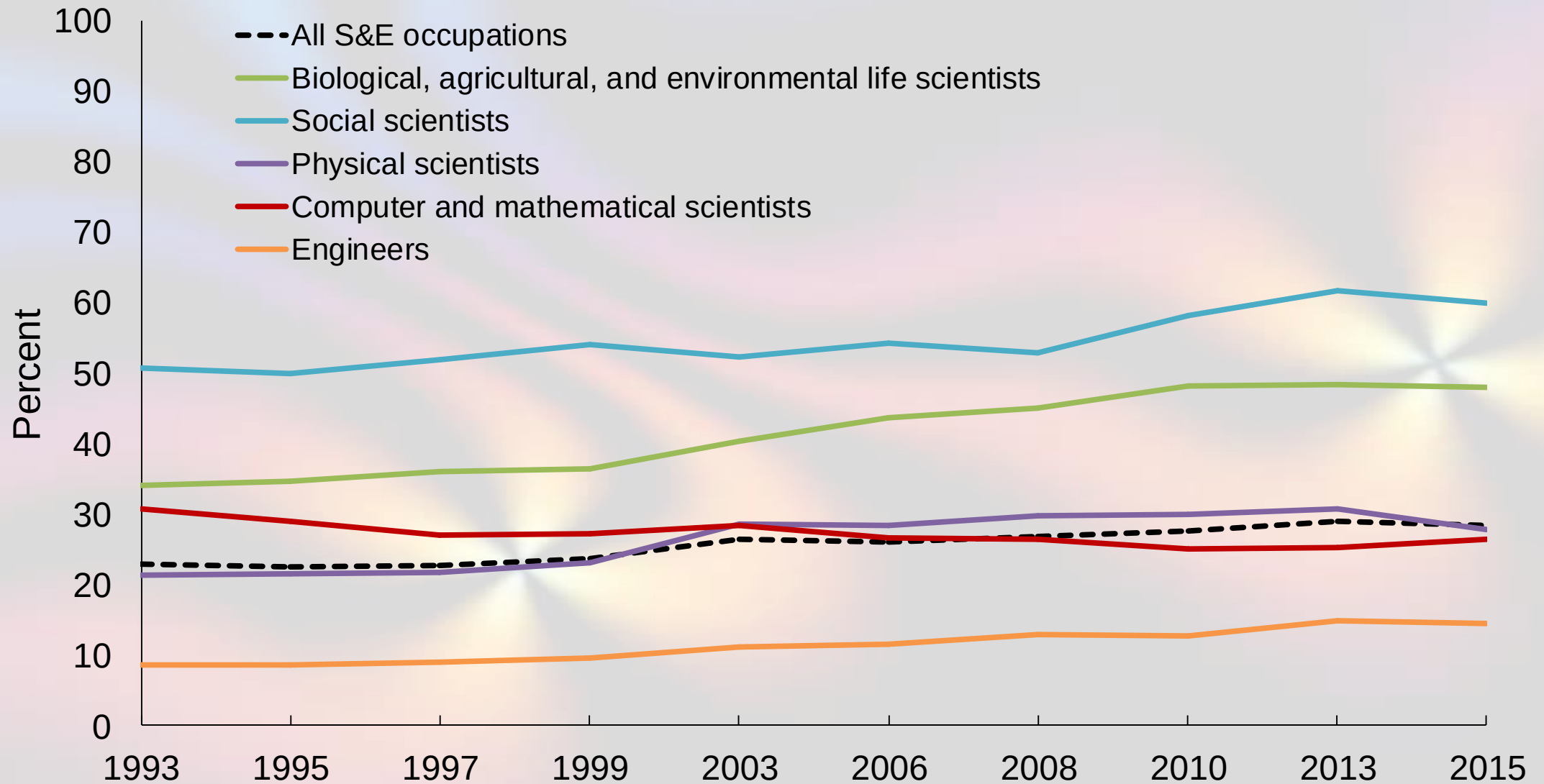
The Skilled Technical Workforce



Share of S&E bachelor's degrees among U.S. citizens and permanent residents, by race and ethnicity: 2000–15



Women in S&E occupations: 1993–2015



Strengthening a STEM-capable U.S. Workforce

- Governments at all levels should empower all segments of our population.
- Businesses should invest in workplace learning programs—such as apprenticeships and internships—that utilize local talent.
- Governments and businesses should expand their investments in community and technical colleges
- Continue to invest in underrepresented segments of our population and leverage our Minority Serving Institutions.

QUESTIONS?

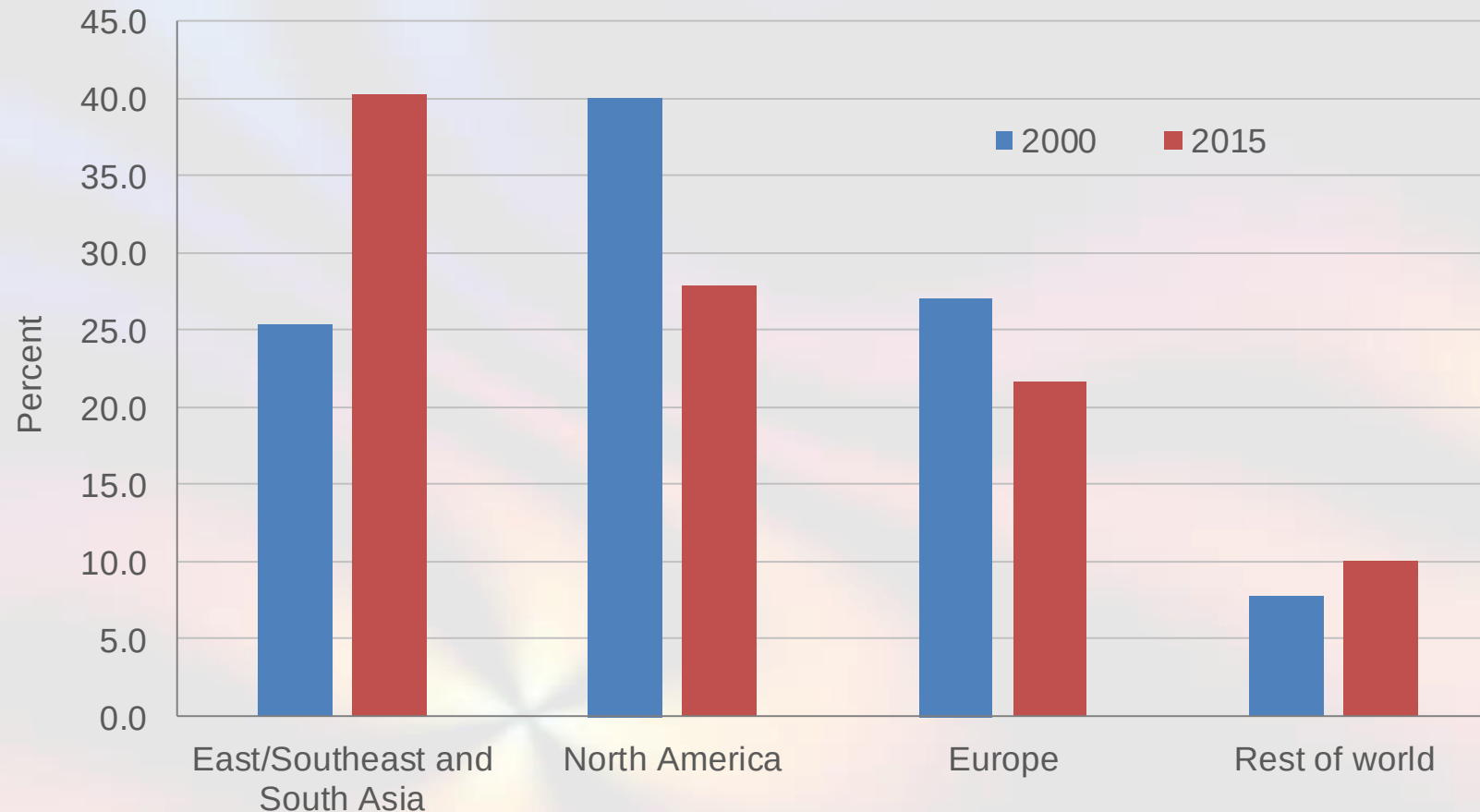
Contact: Nadine Lymn; nlymn@nsf.gov

Additional Slides



Share of global R&D in selected regions: 2000 and 2015

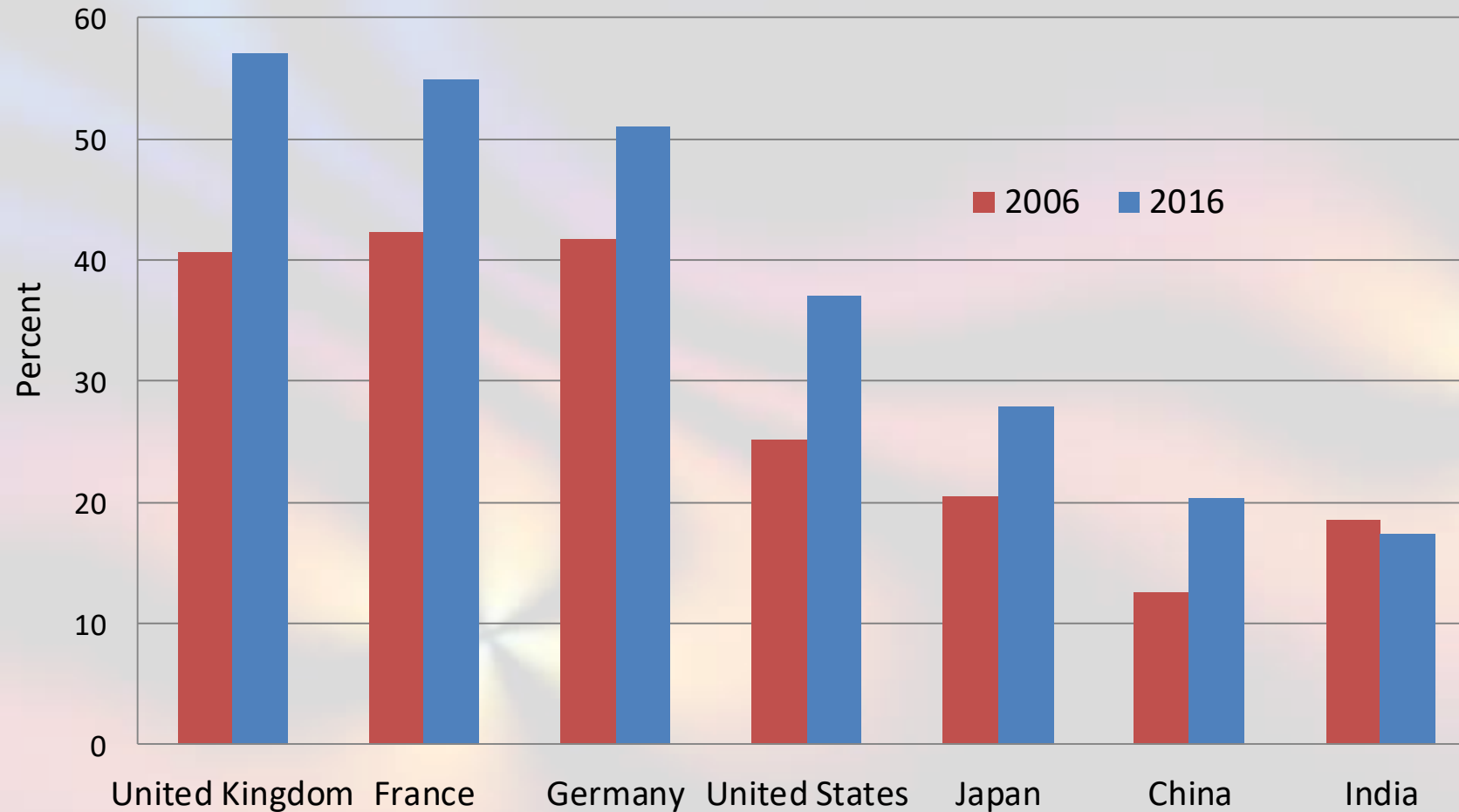
[Global R&D expenditures are geographically concentrated!]



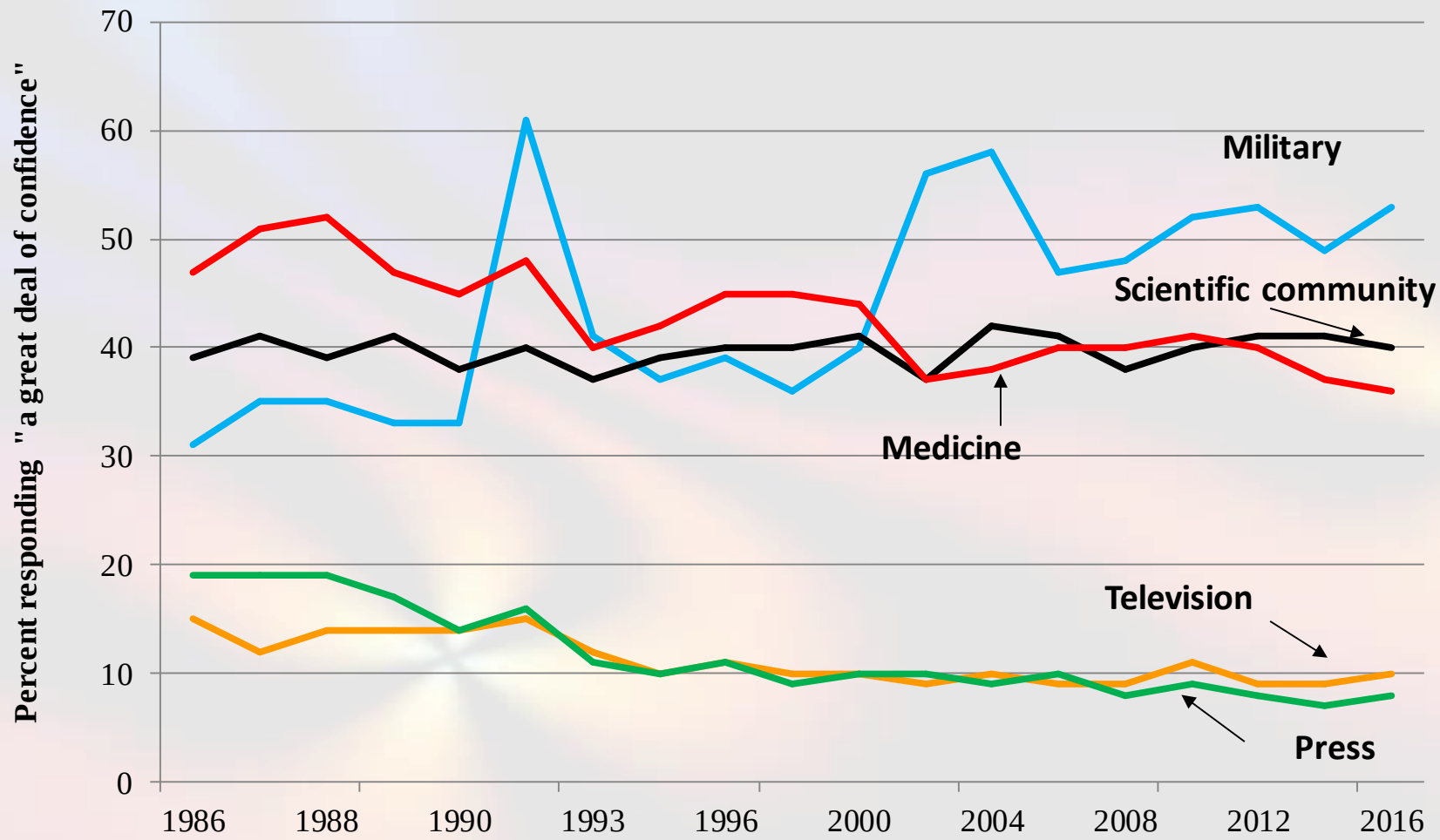
NOTE: East/Southeast and South Asia includes China, Taiwan, Japan, South Korea, Singapore, Malaysia, Thailand, Indonesia, Philippines, Vietnam, India, Pakistan, Nepal, and Sri Lanka.



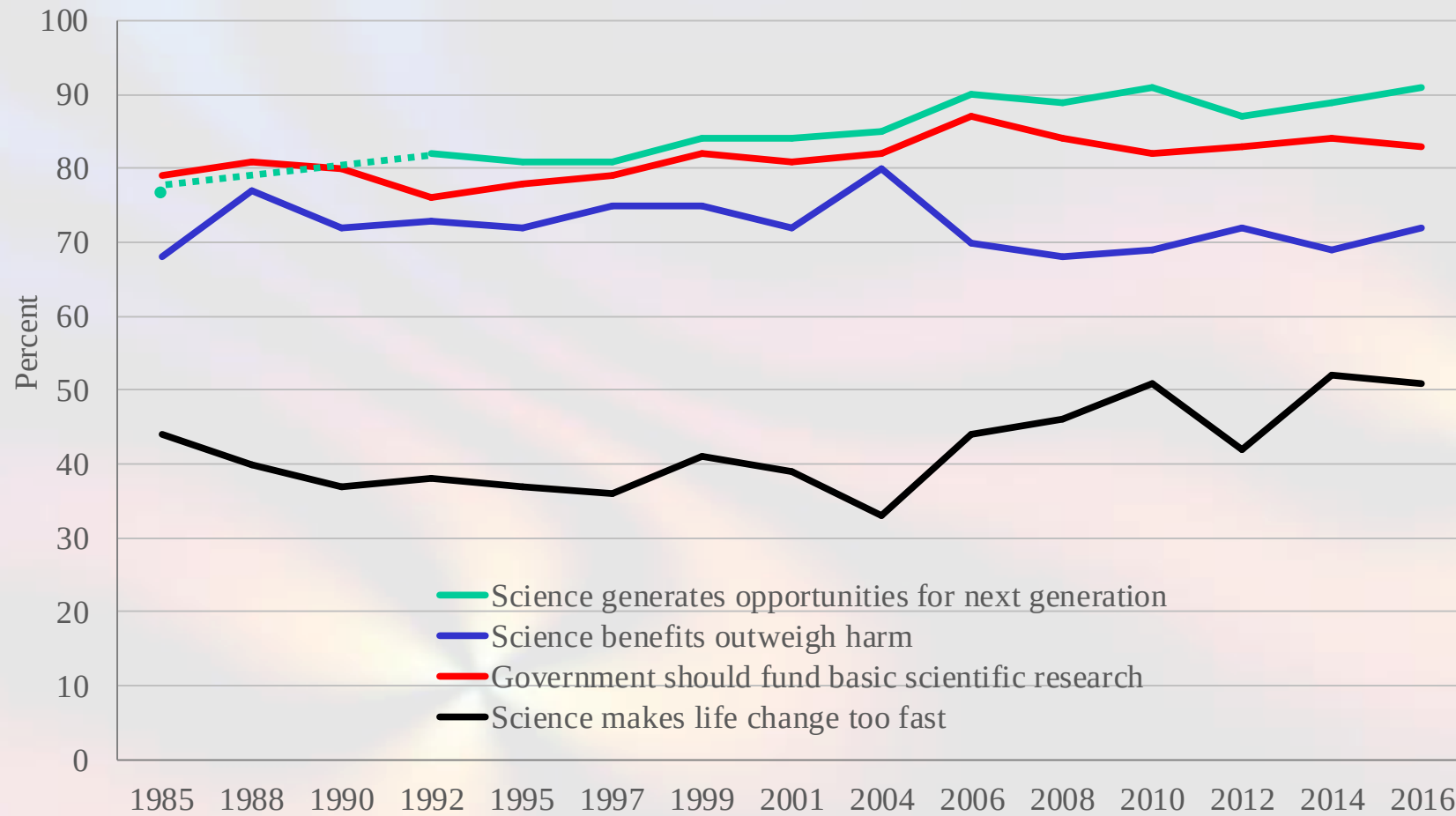
Share of S&E articles internationally coauthored, 2006 and 2016



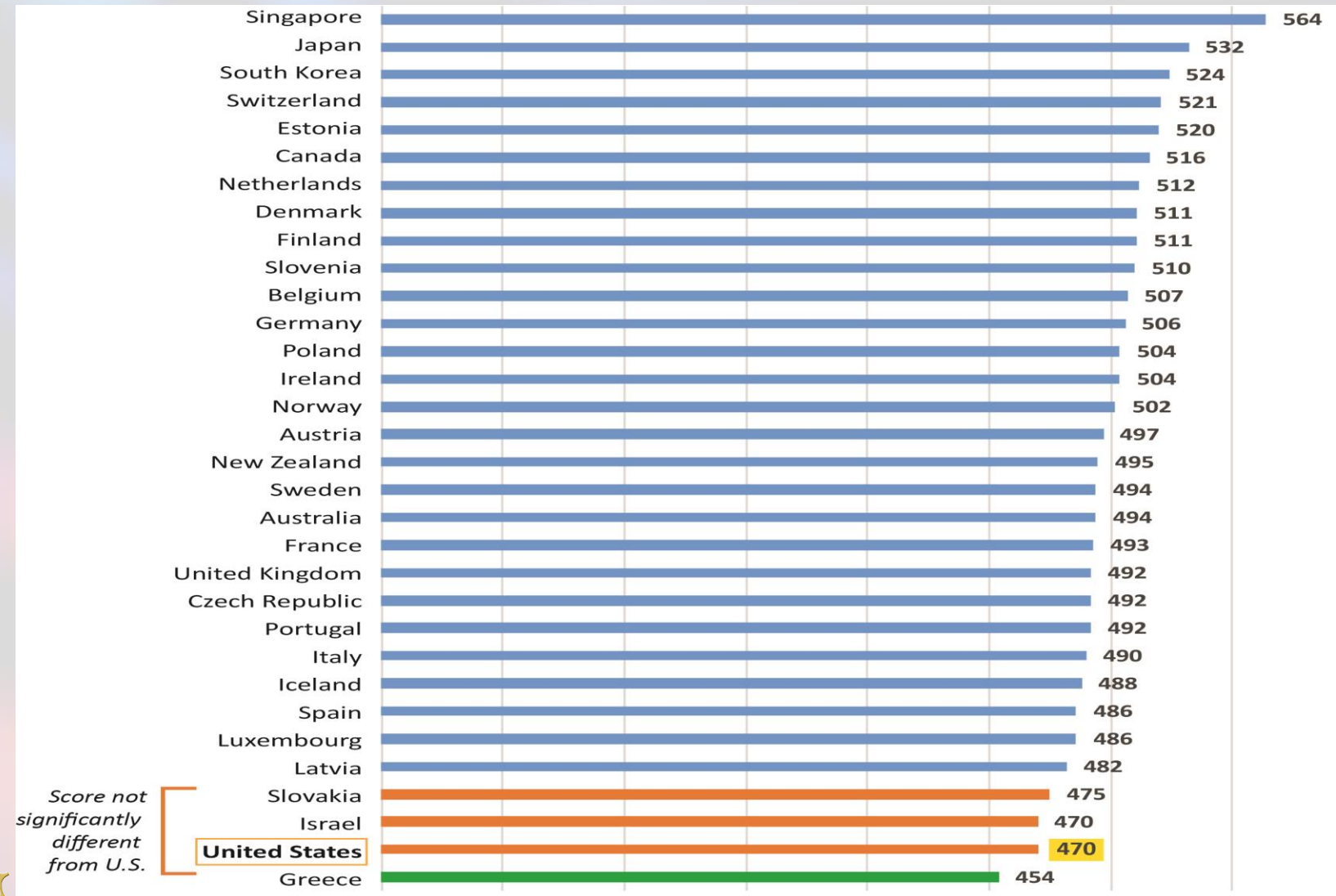
Public confidence in institutional leaders, by type of institution: 1986-2016



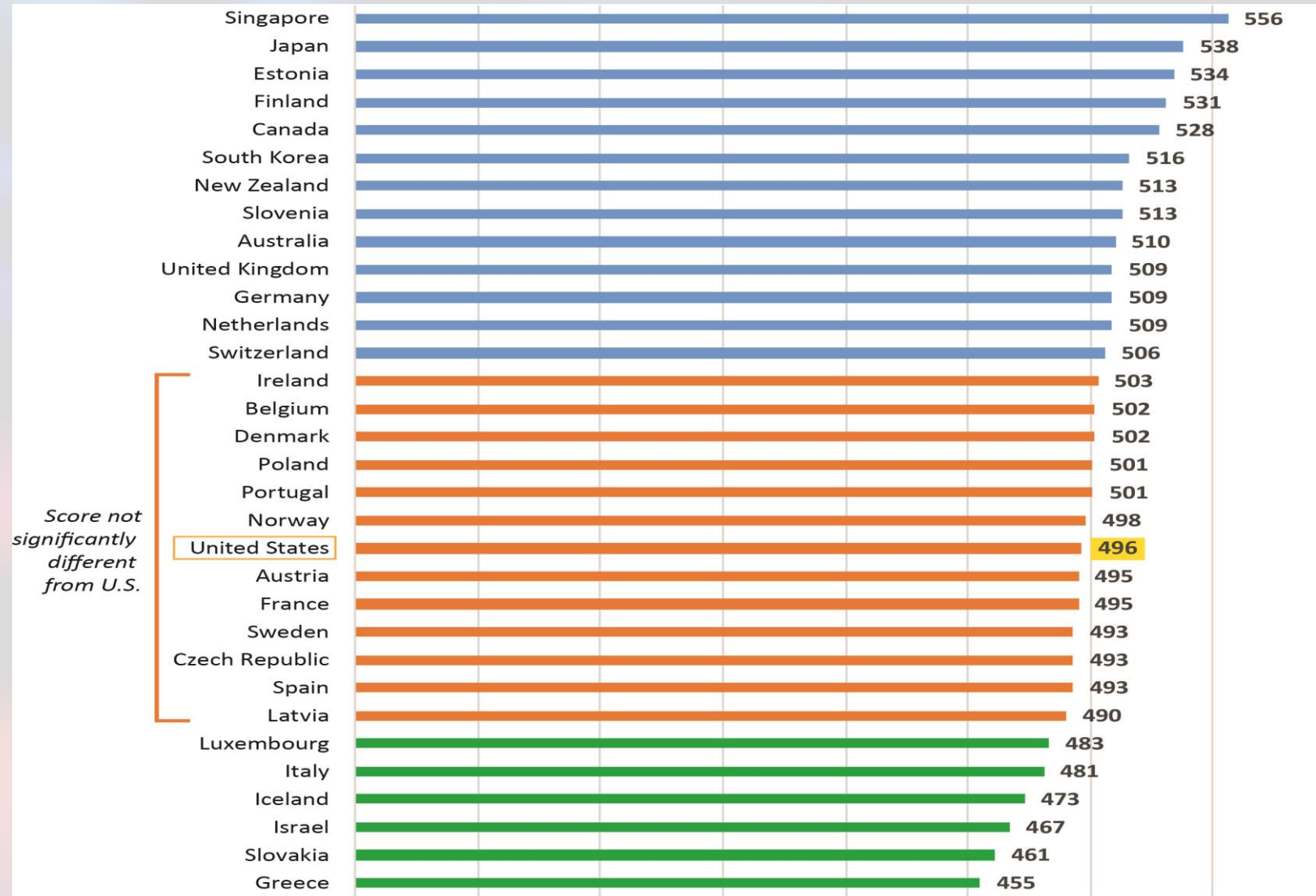
Americans' views of science 1985-2016



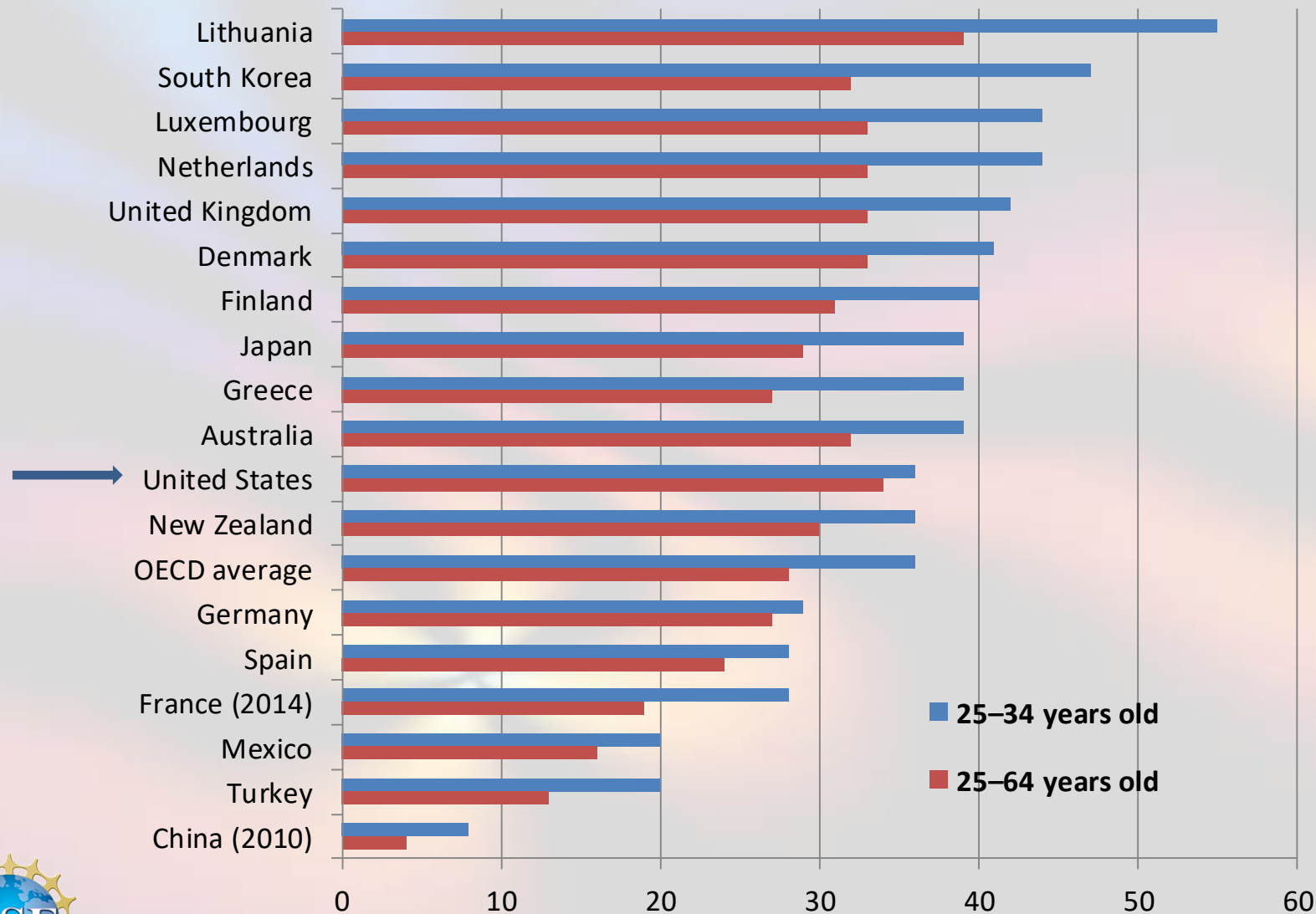
Mean mathematics literacy assessment scores of 15-year-olds in developed countries: 2015



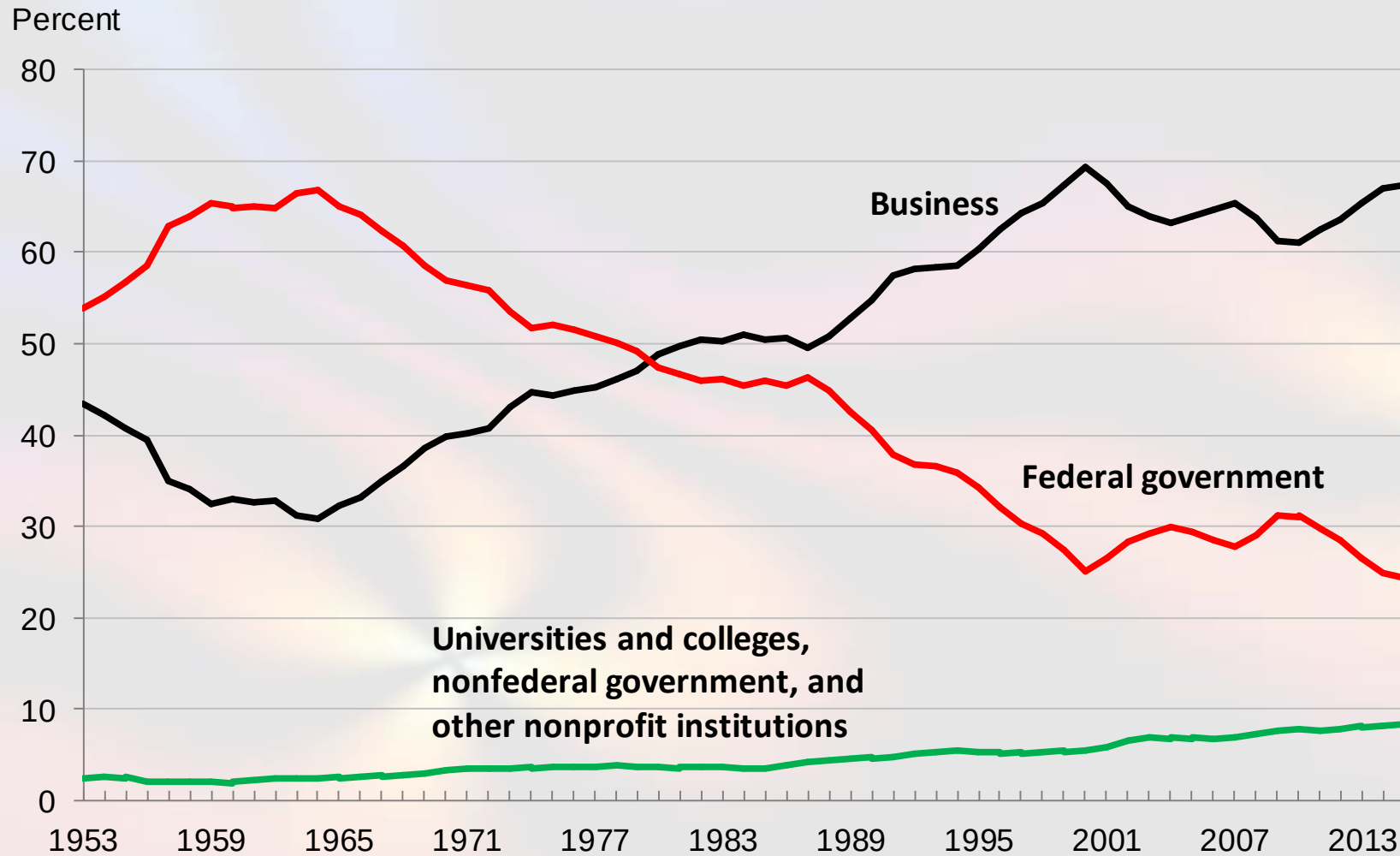
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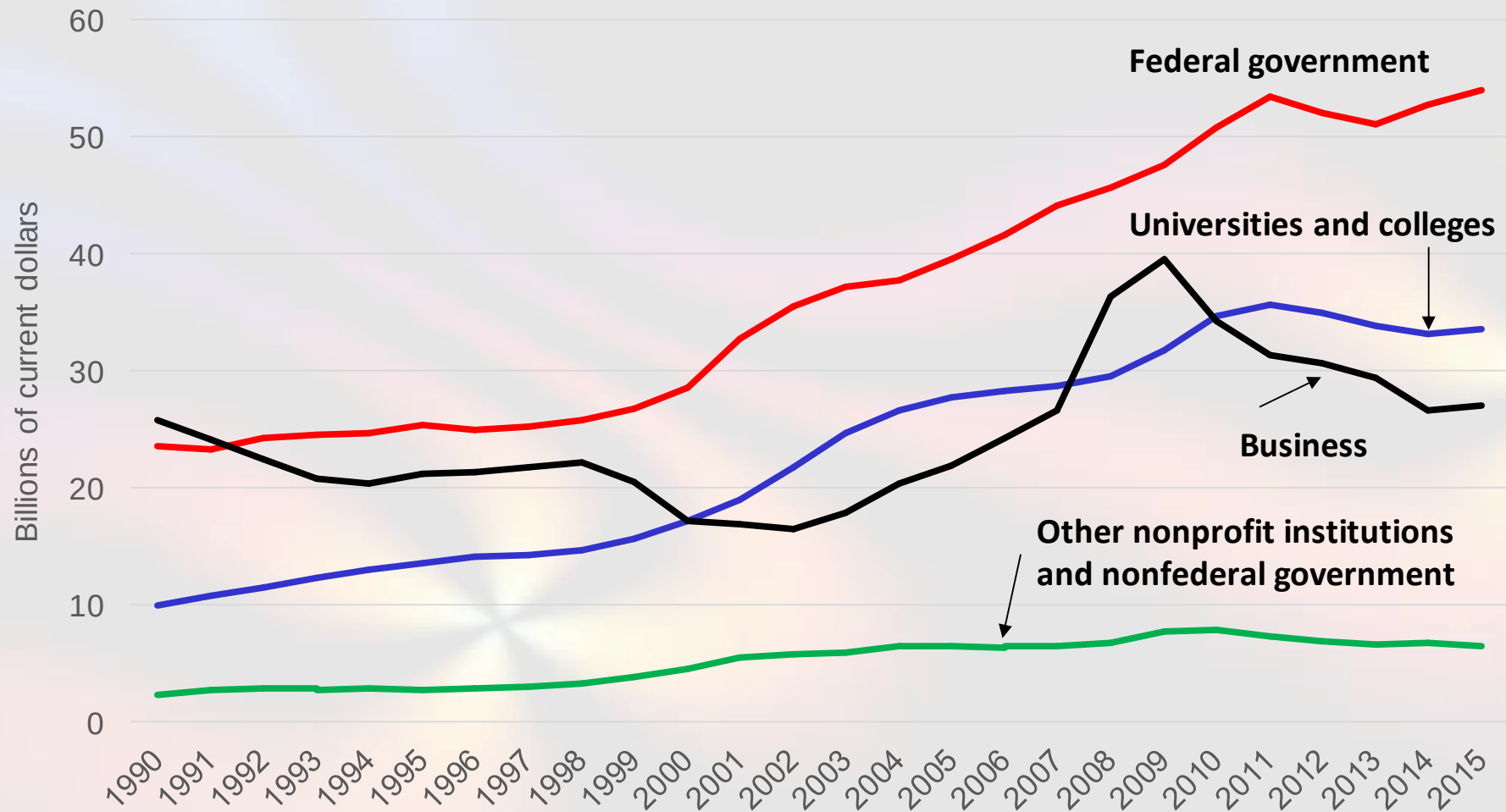
Attainment of bachelor's or higher degrees (percent) by country and age group: 2015



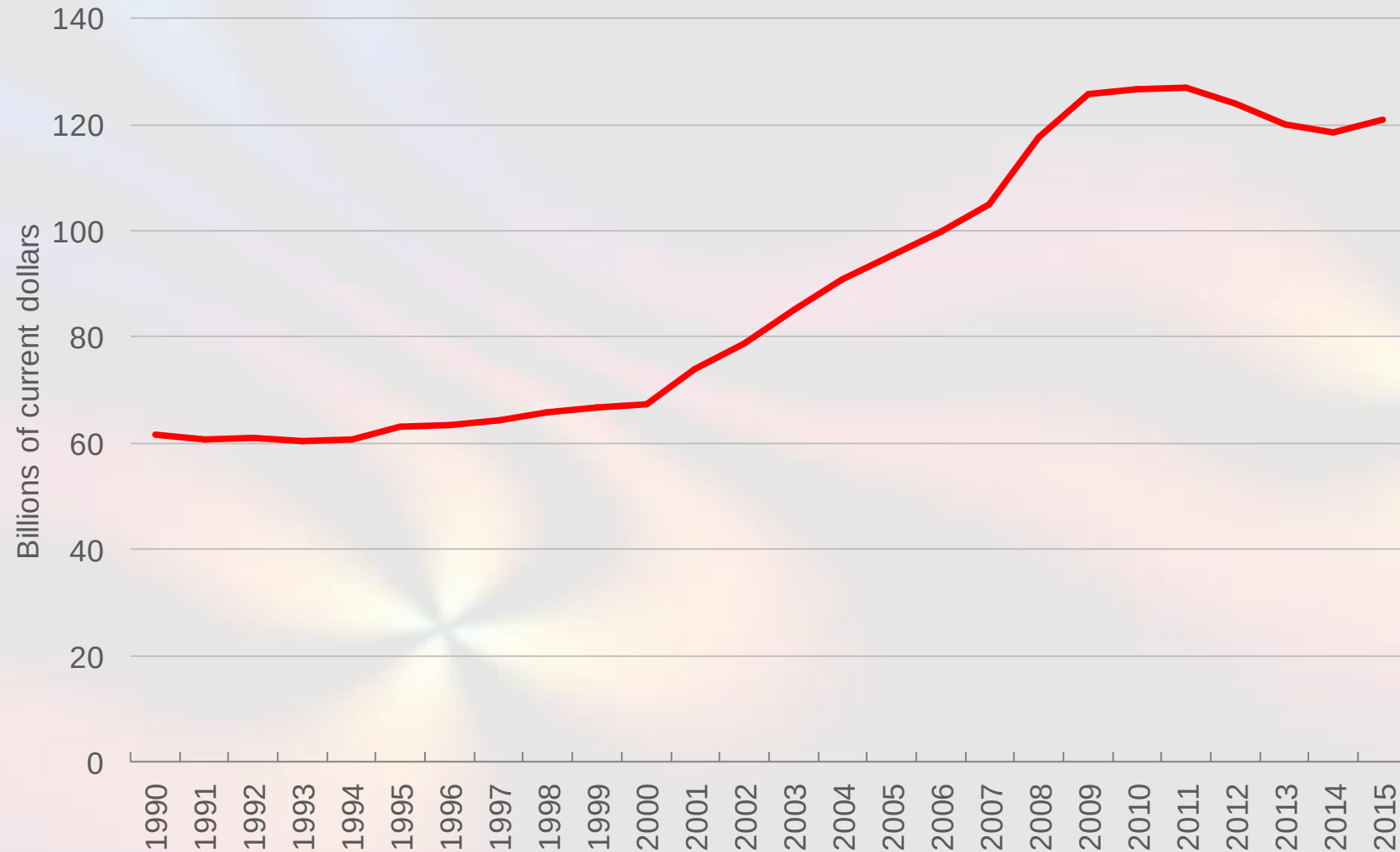
U.S. R&D expenditures: by source of funds 1953–2015



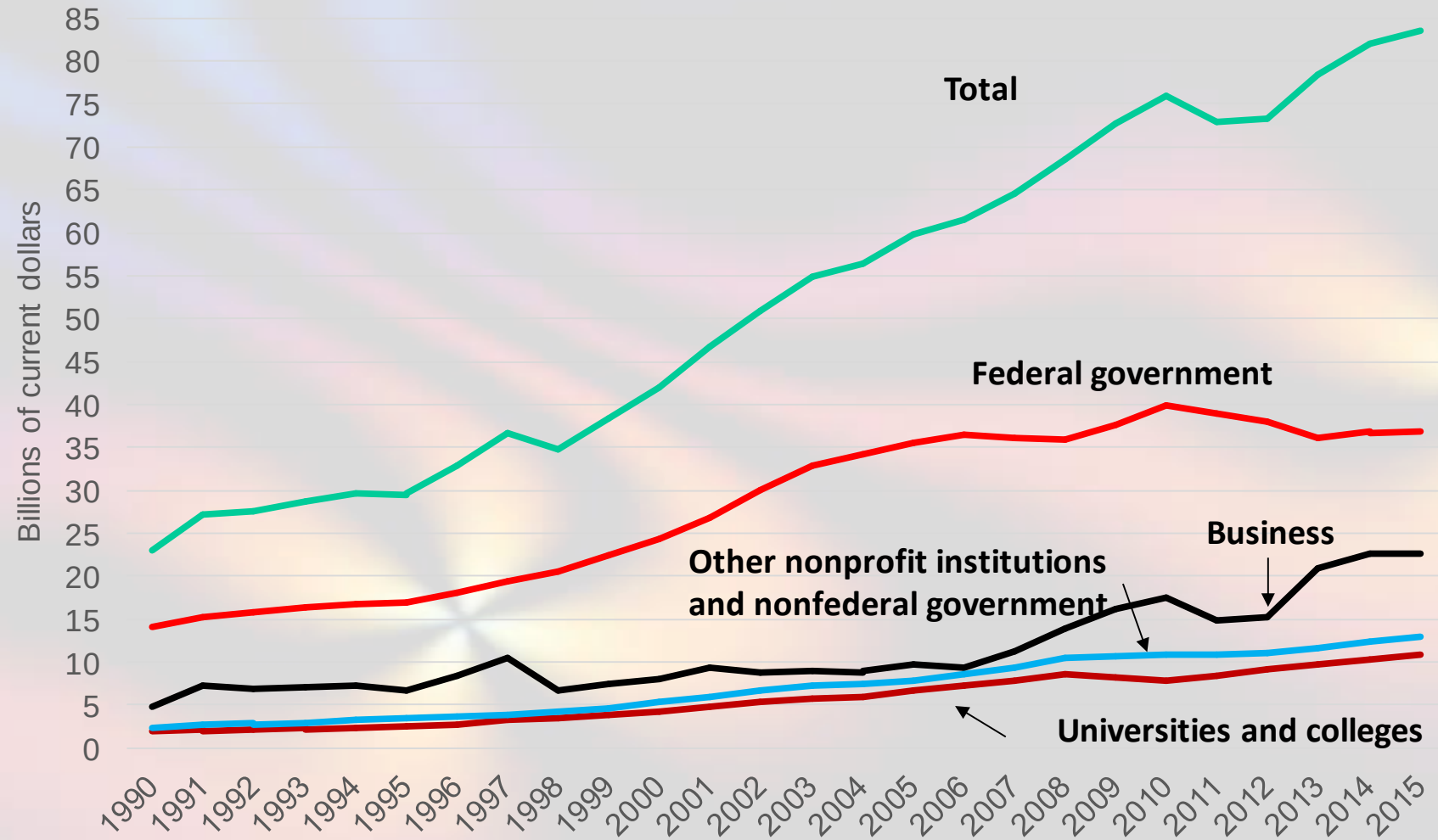
Federal R&D funding, by performing sector 1990–2015



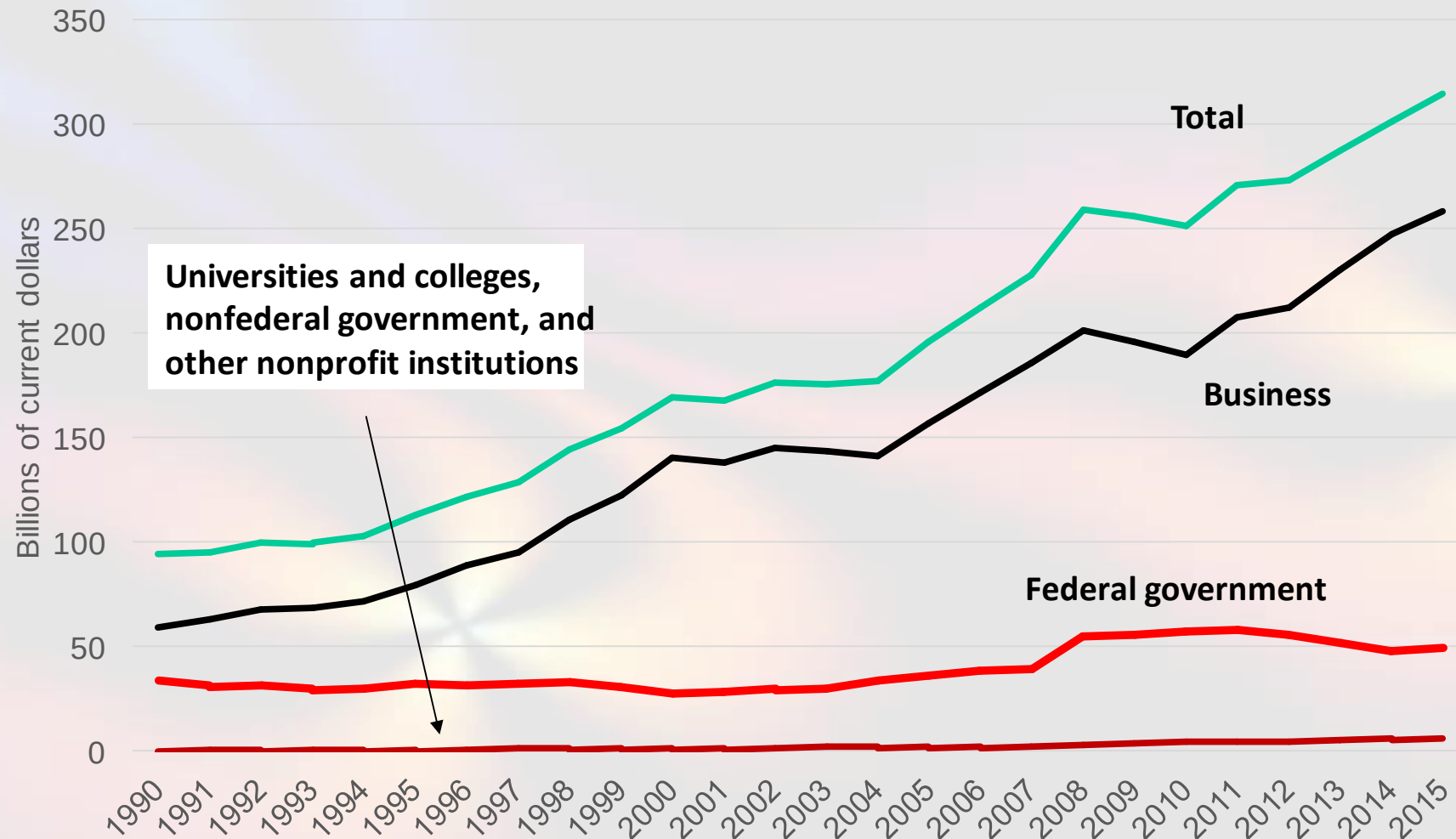
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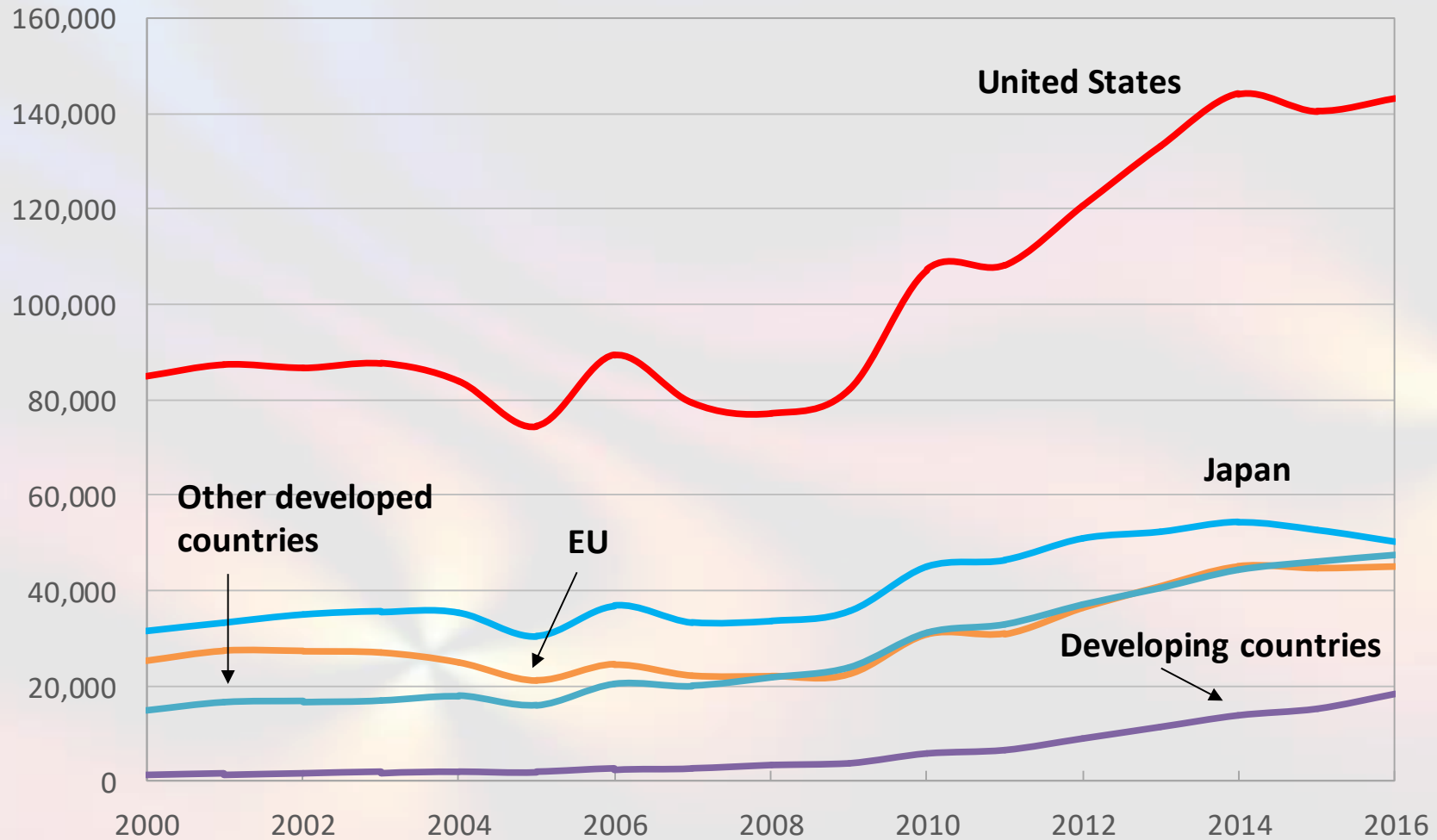
Funding sources for U.S. basic research 1990–2015



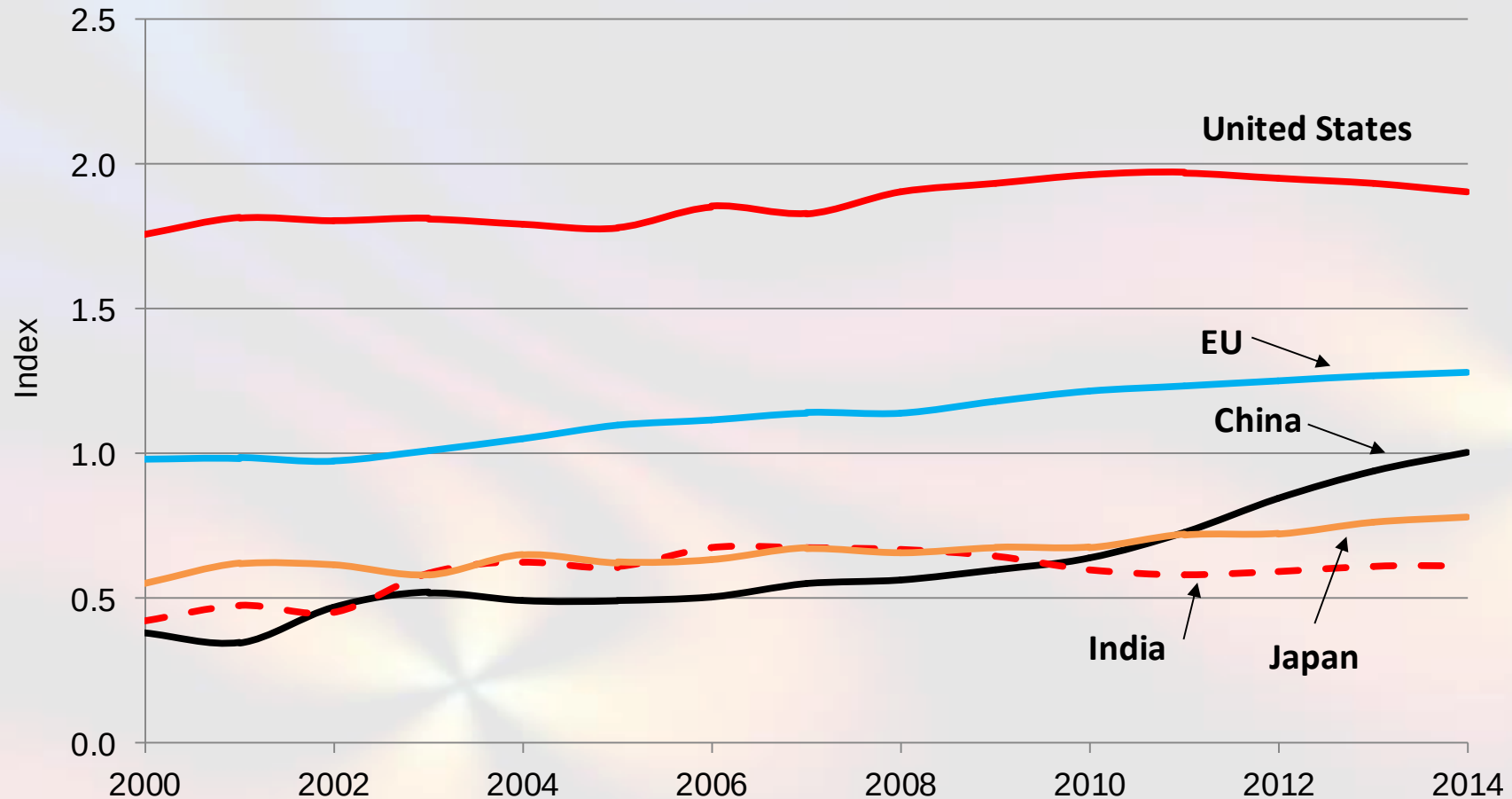
Funding sources for U.S. development 1990–2015



USPTO patents granted, by location of inventor: 2000–16



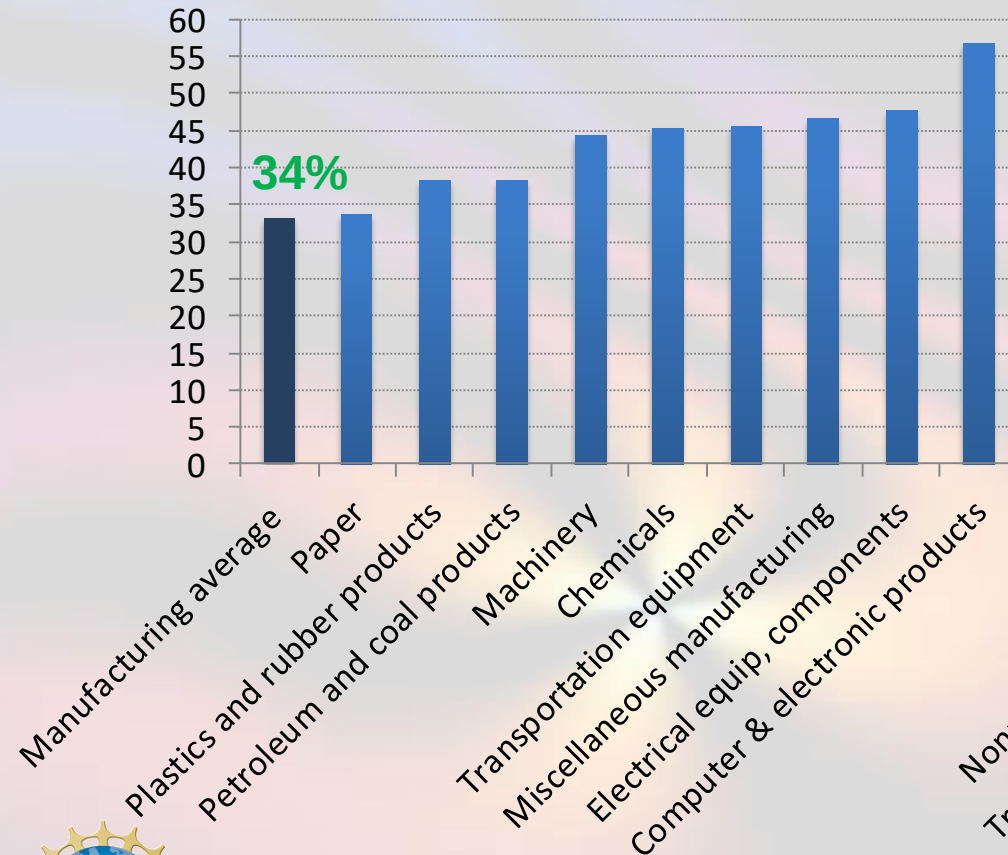
S&E publication output in the top 1% of cited publications globally: 2000–14



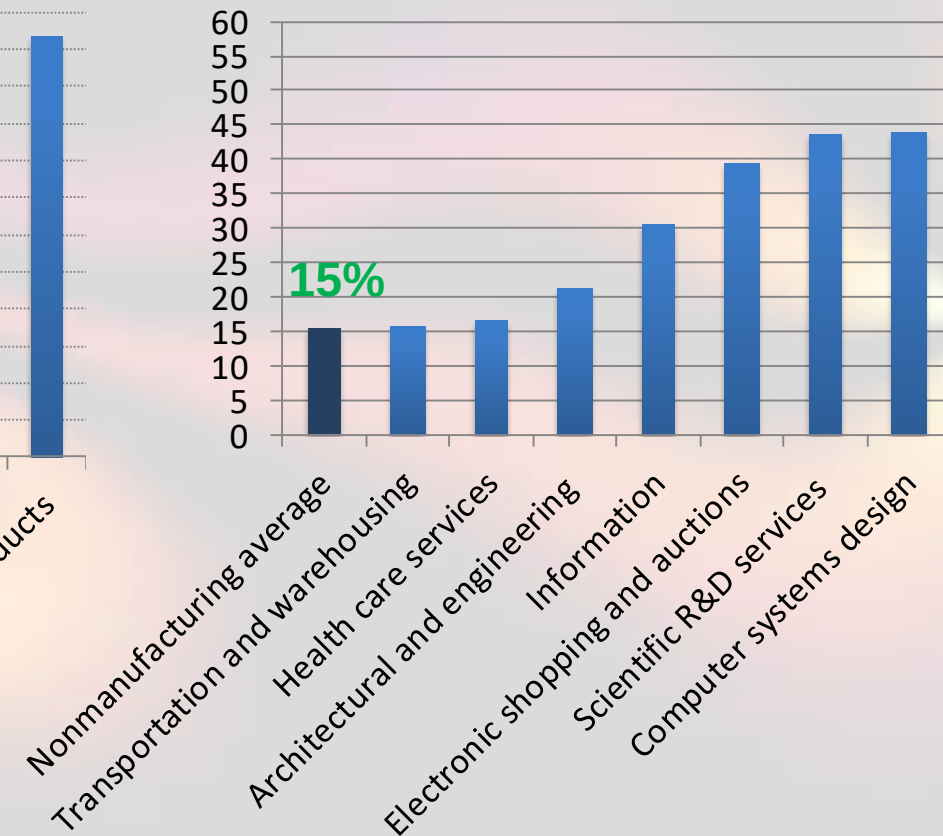
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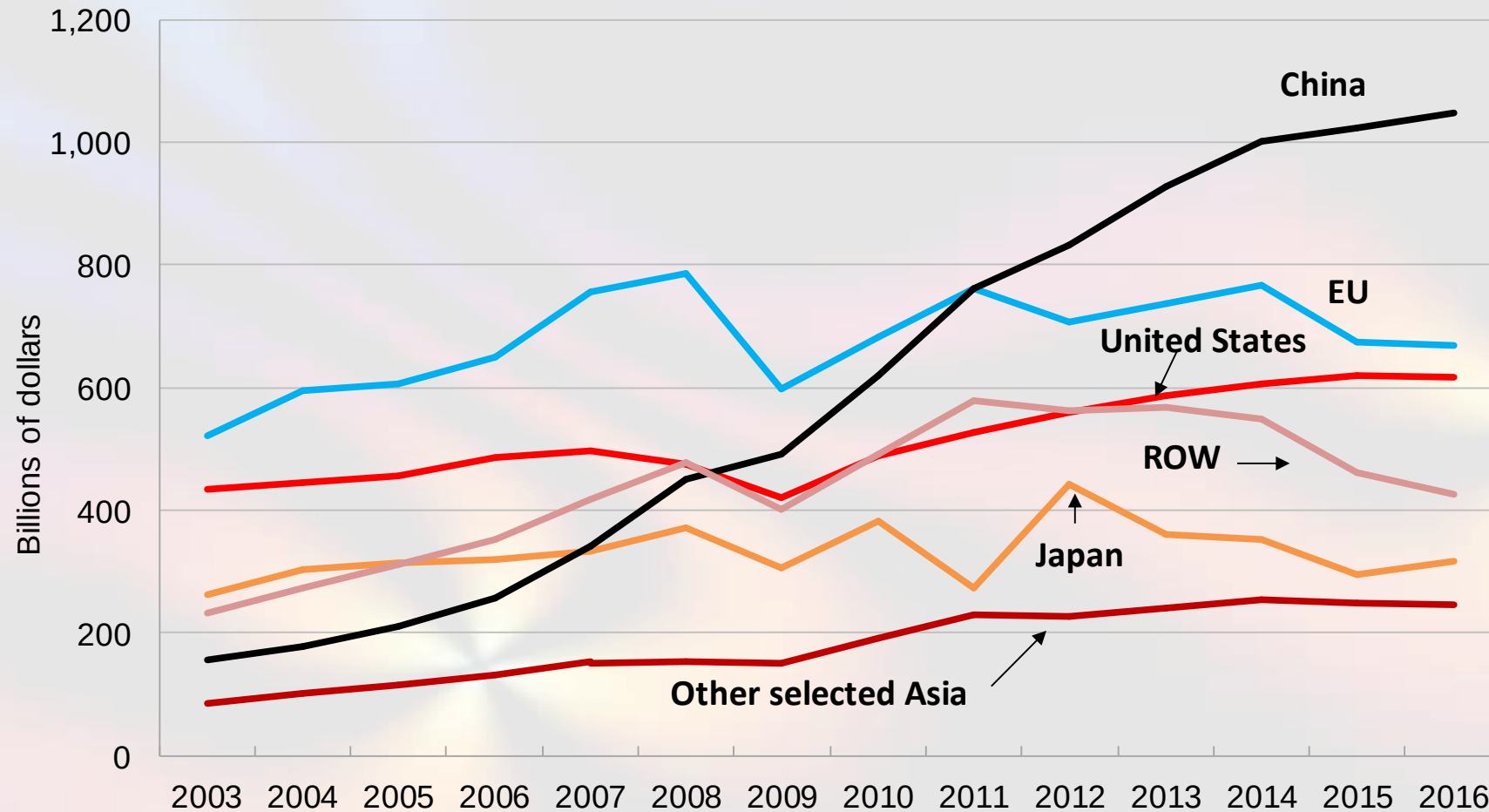
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Value-added output of medium HT manufacturing industries: 2003–16



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Innovation Takes Place Within an Interconnected System

Chapter 8

❖ Invention

❖ Knowledge Transfer

❖ Innovation

➤ Investment in Intangibles

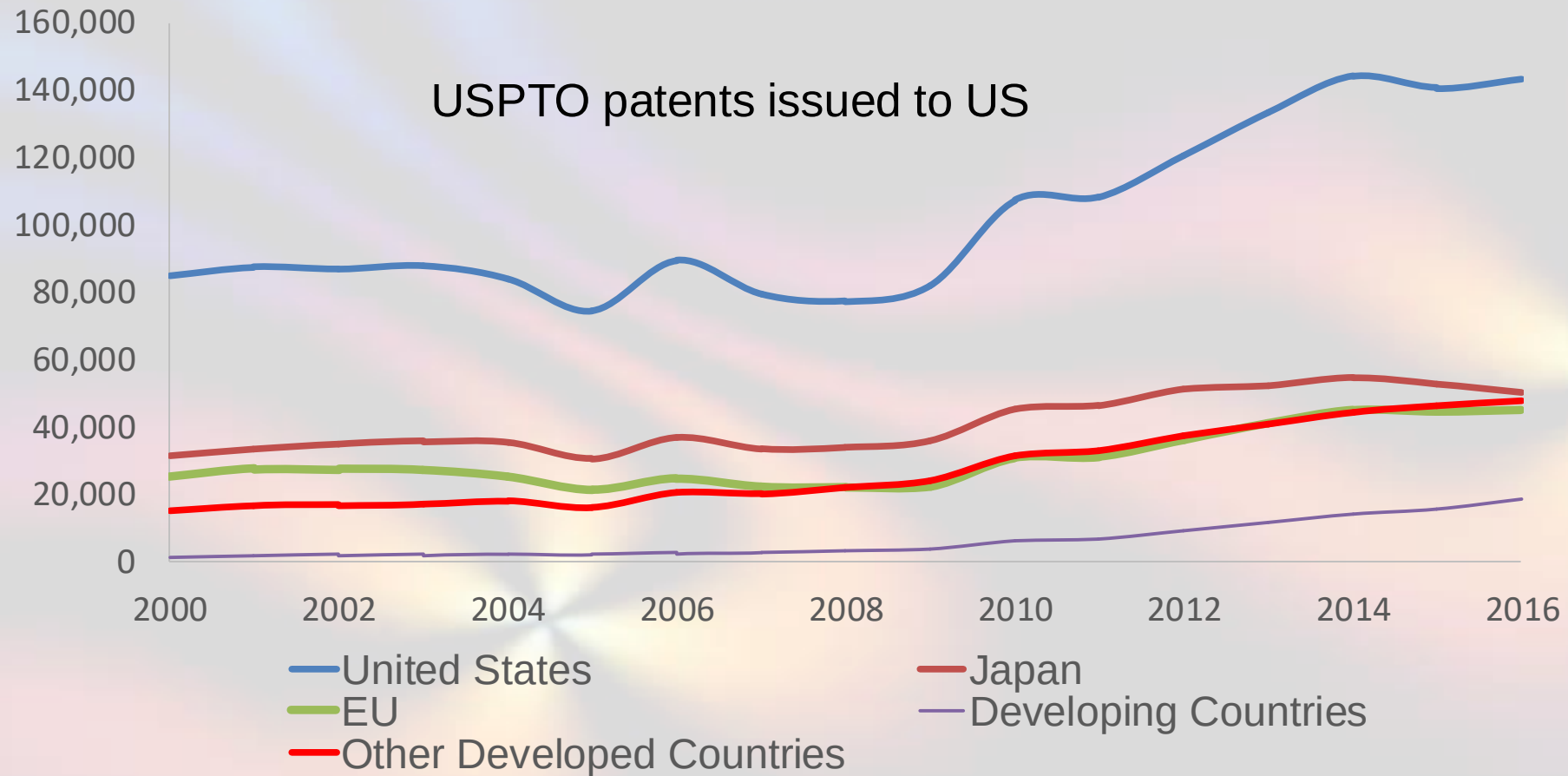
➤ Share of US Firms introducing innovations

❖ Multiple Indicators

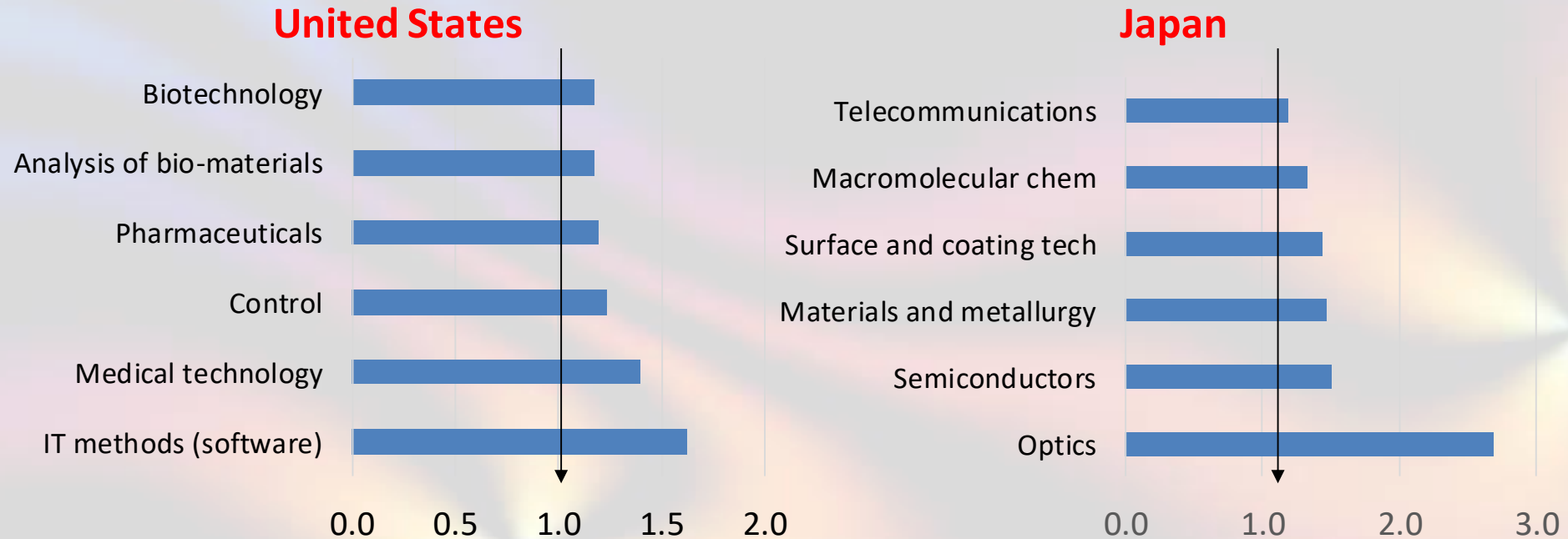


Patents are One Measure of Invention: USPTO

Patents 2000–16



Patent Specialization for the US and Japan: 2014–16



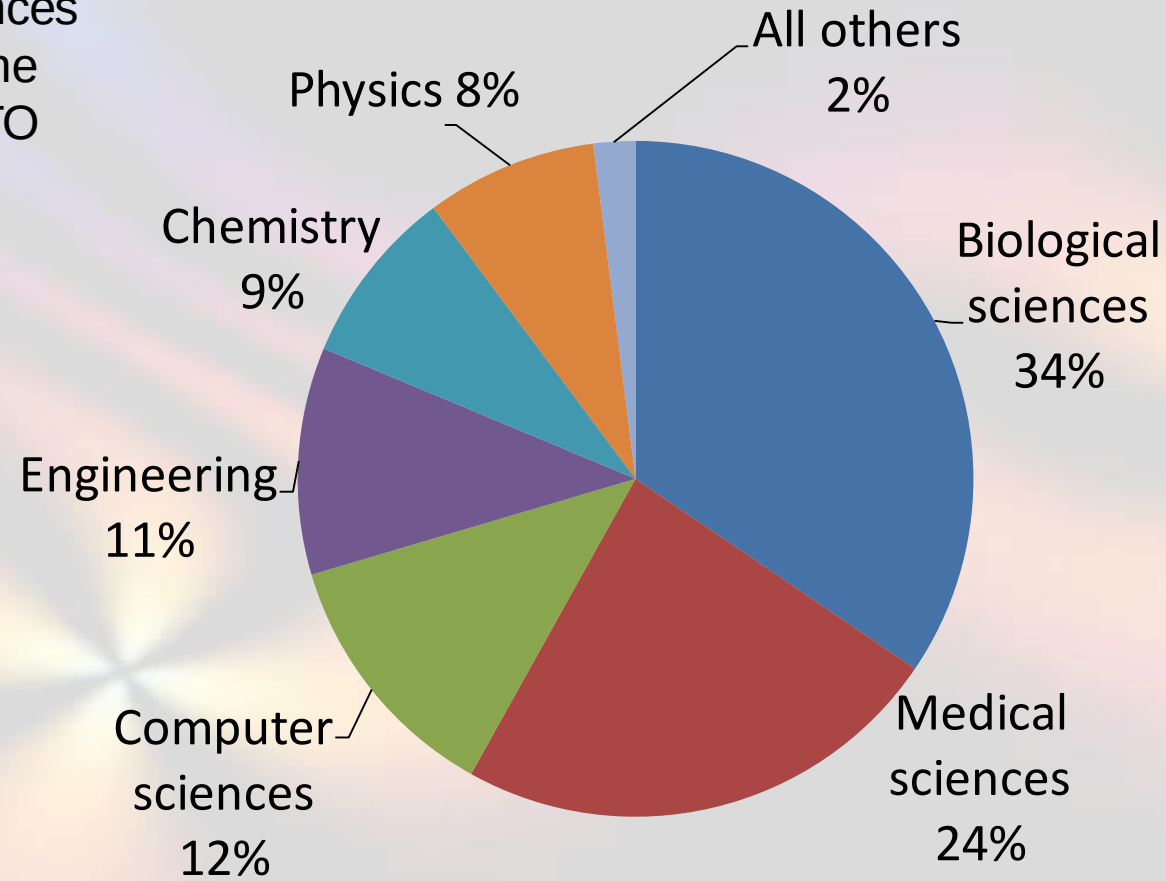
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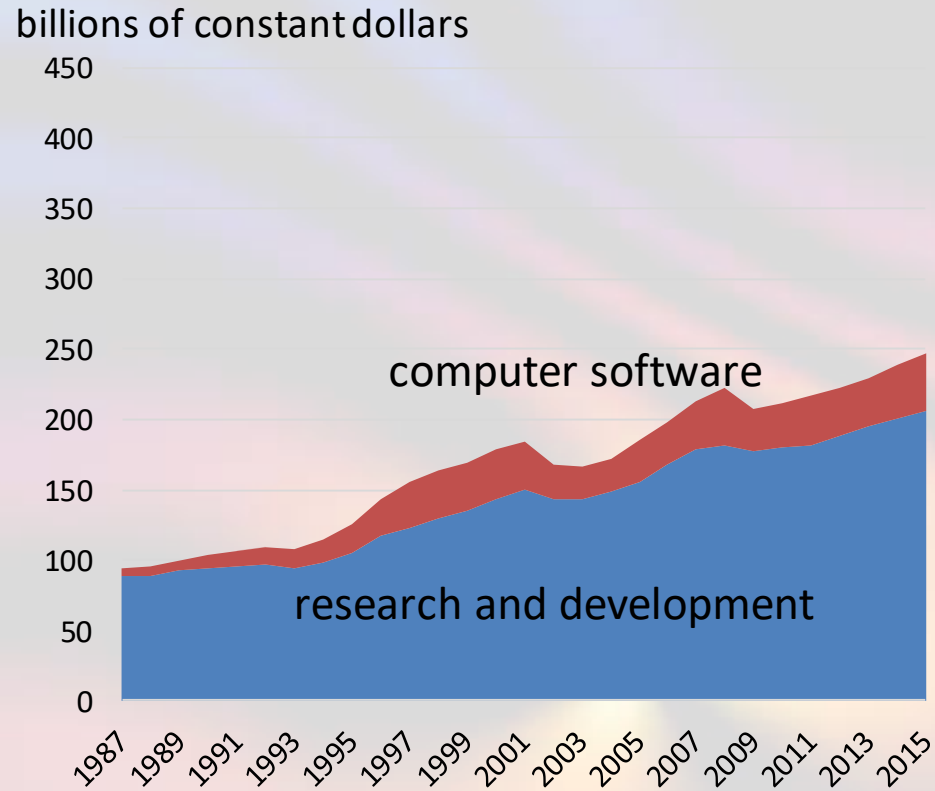
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Investment in Intangibles Contributes to Innovation

Manufacturing



Nonmanufacturing

