



National Science Board

2020 NATIONAL SCIENCE BOARD
SCIENCE & ENGINEERING INDICATORS

The State of U.S. Science
& Engineering



The State of U.S. Science & Engineering

Science and Engineering Indicators 2020

Julia M. Phillips, Chair
NSB Committee on National S&E Policy

Thursday, April 23, 2020

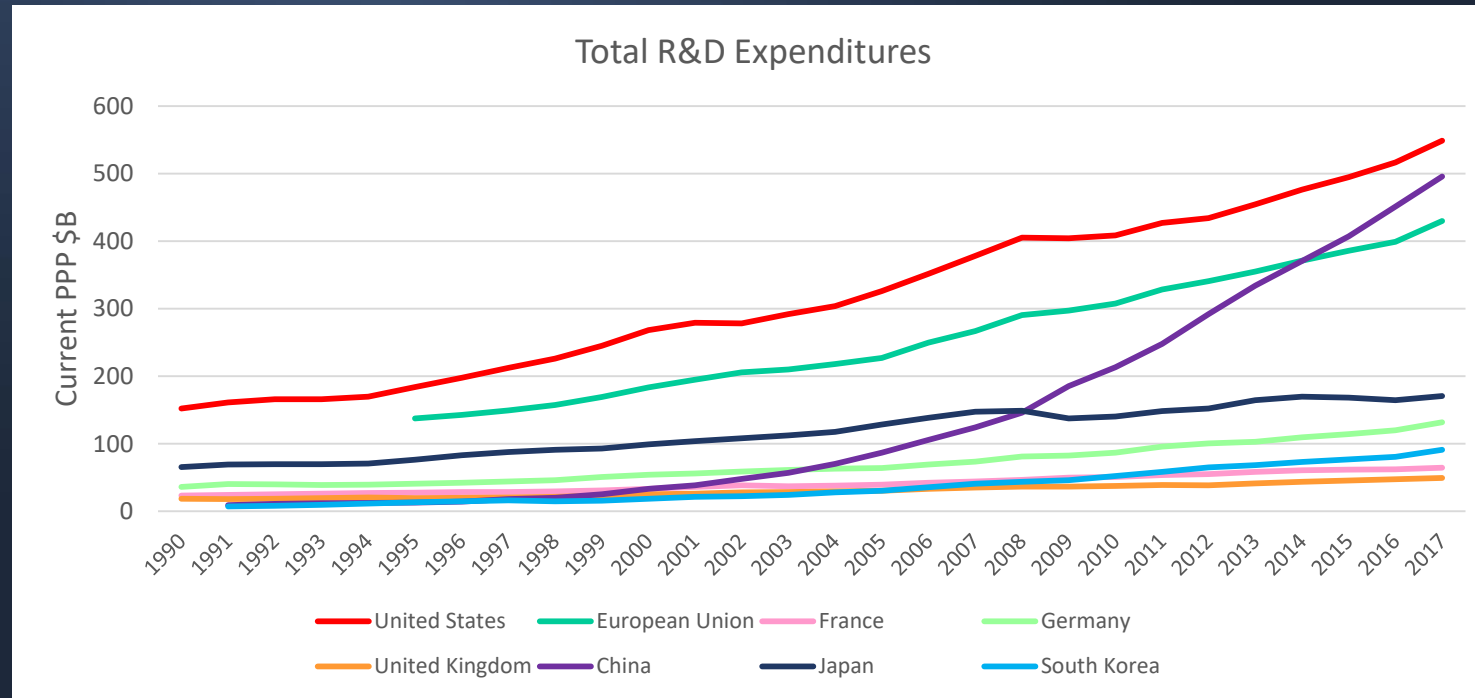


Image credit: Oliver H. Beauchesne
and SCImago Lab
Data: Elsevier Scopus

Science & Engineering: A New Global Context



Global Investment in Research & Development



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R&D Definitions

Basic research – experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, not directed toward any particular use.

Applied research – original investigation undertaken in order to acquire new knowledge, directed primarily towards a specific, practical aim or objective.

Fundamental research = basic + applied research

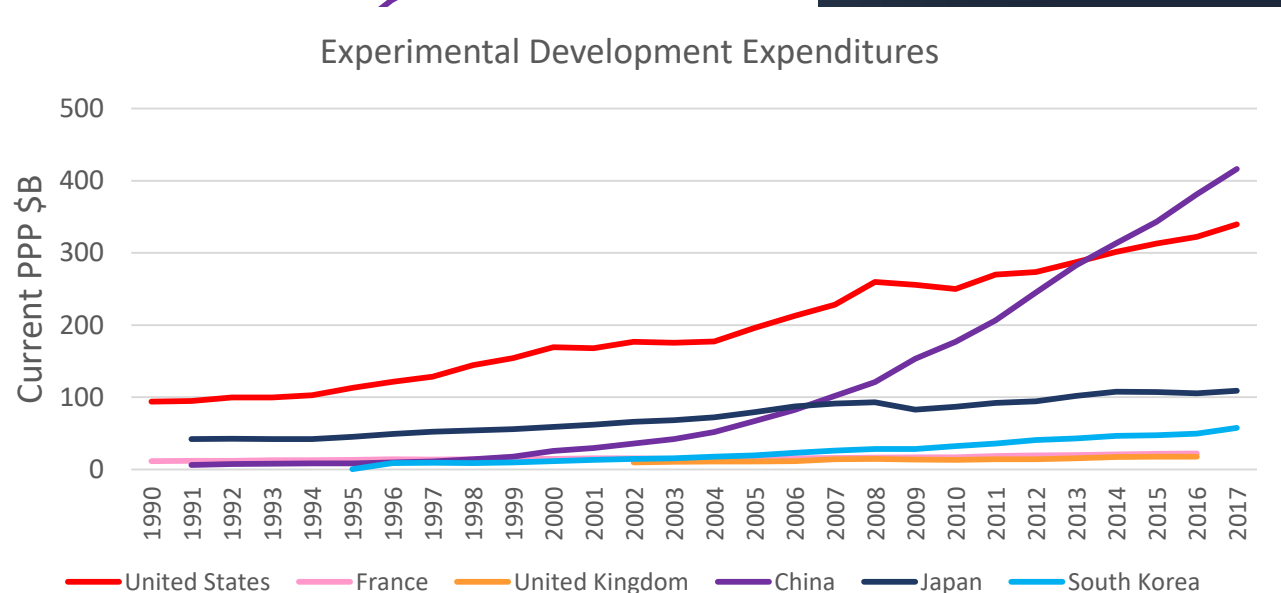
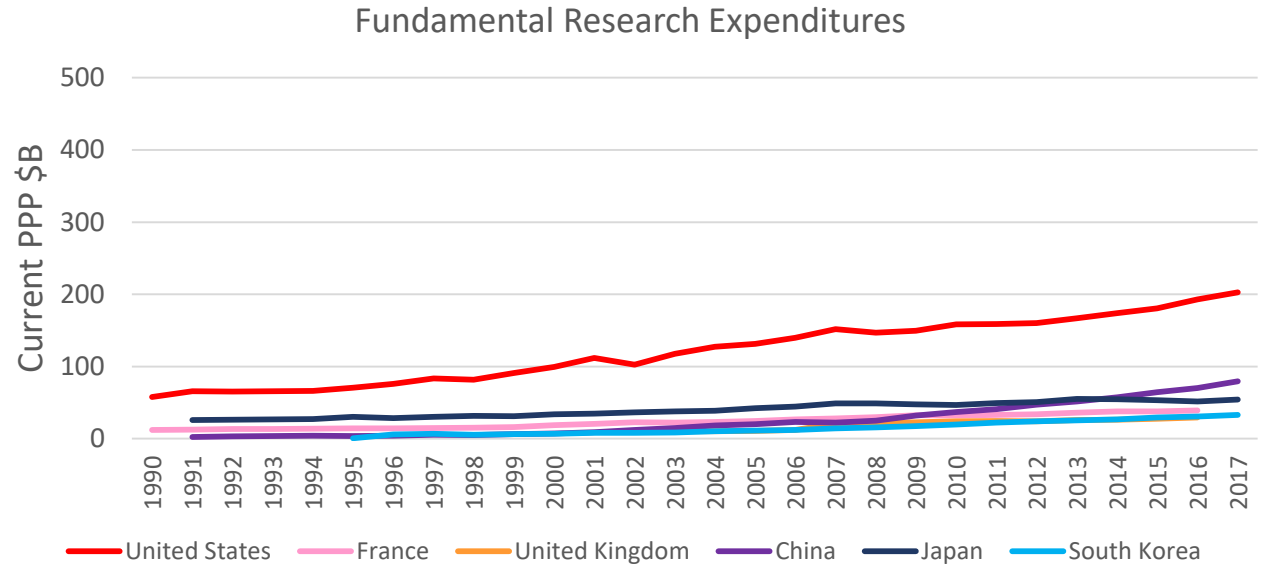
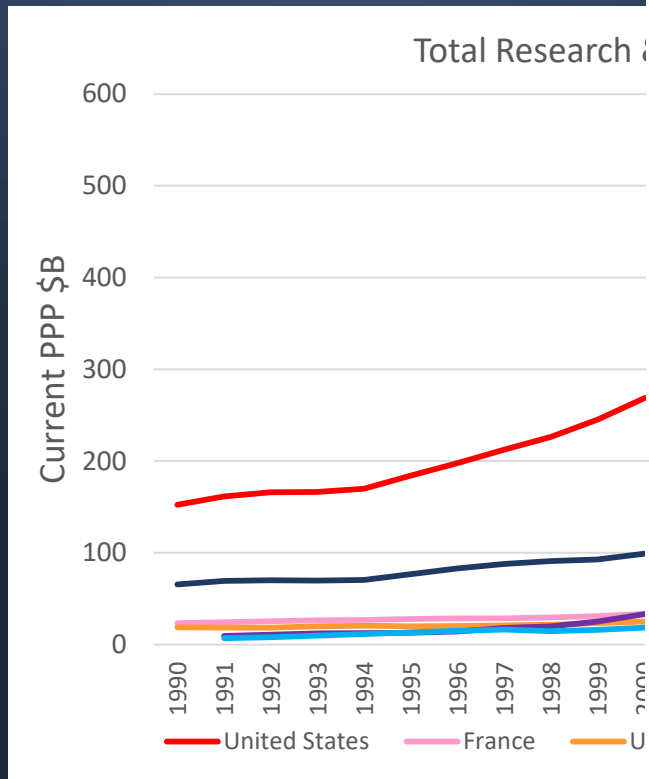
Experimental development – systematic effort, based on existing knowledge from research or practical experience, directed toward creating novel or improved materials, products, devices, processes, systems, or services.



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Global Investment in Research & Development

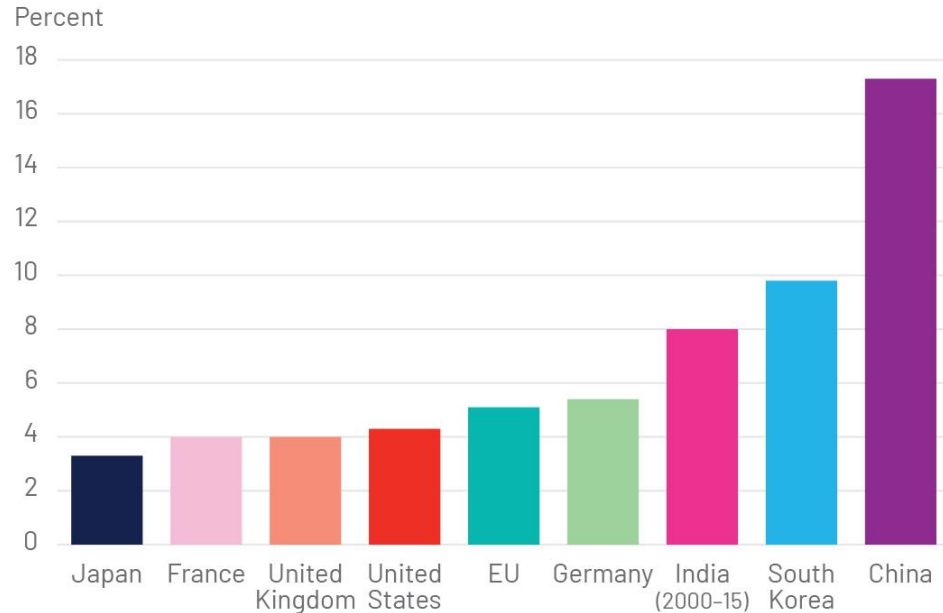


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Shift in Global R&D Expenditures

Figure 13. Average annual growth rate of domestic R&D expenditures, by selected region, country, or economy: 2000-17

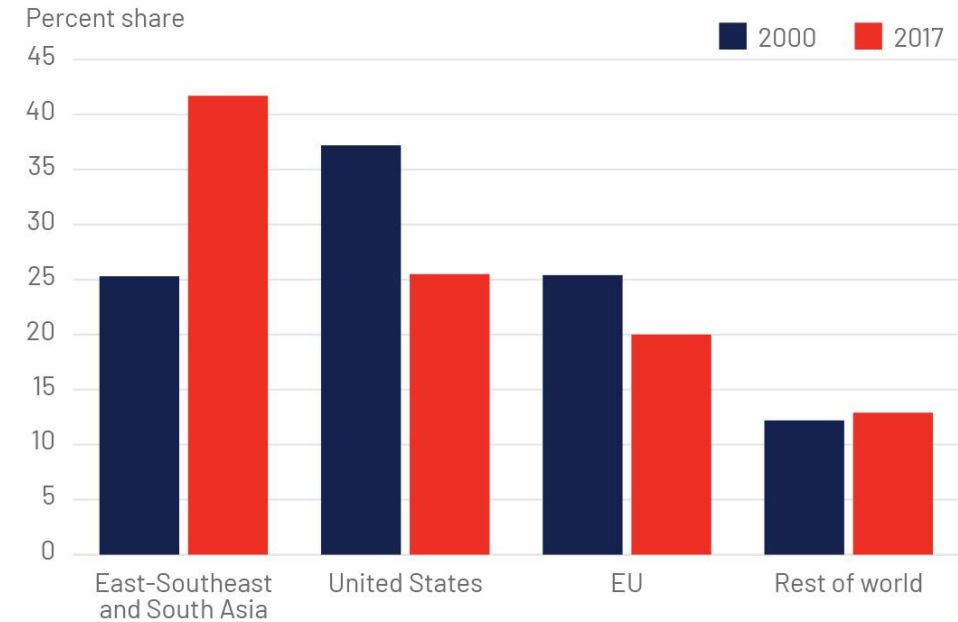


NOTE: The EU includes France, Germany, and the United Kingdom.

SOURCES: NCSES, National Patterns of R&D Resources; OECD, MSTI 2019/1; UNESCO, UIS R&D.

Indicators 2020: R&D

Figure 14. Shares of worldwide R&D expenditures, by selected region, country, or economy: 2000 and 2017



NOTE: East-Southeast and South Asia include Cambodia, China, India, Indonesia, Japan, Malaysia, Mongolia, Myanmar, Nepal, Pakistan, Philippines, Singapore, South Korea, Sri Lanka, Taiwan, Thailand, and Vietnam.

SOURCES: OECD, MSTI 2019/1; UNESCO, UIS R&D.

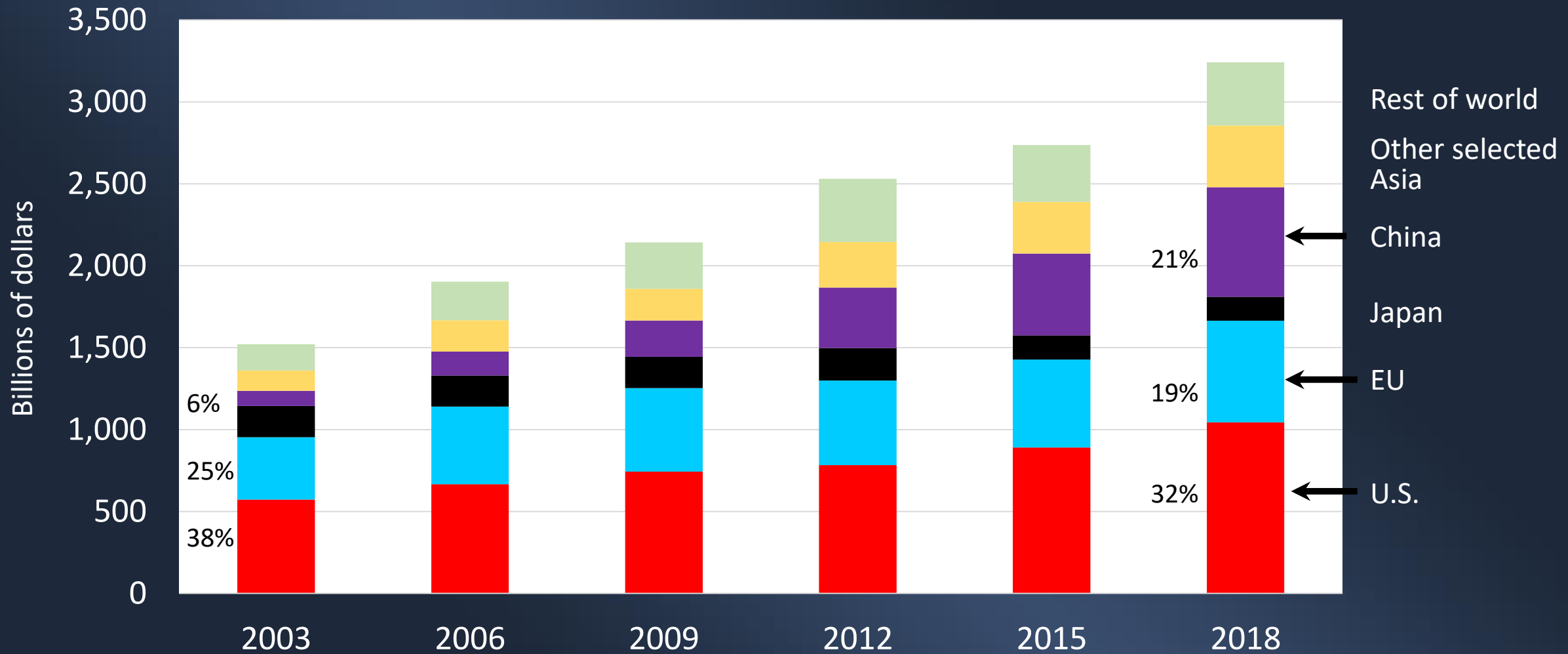
Indicators 2020: R&D



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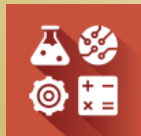
Global High R&D Intensive Industry Output



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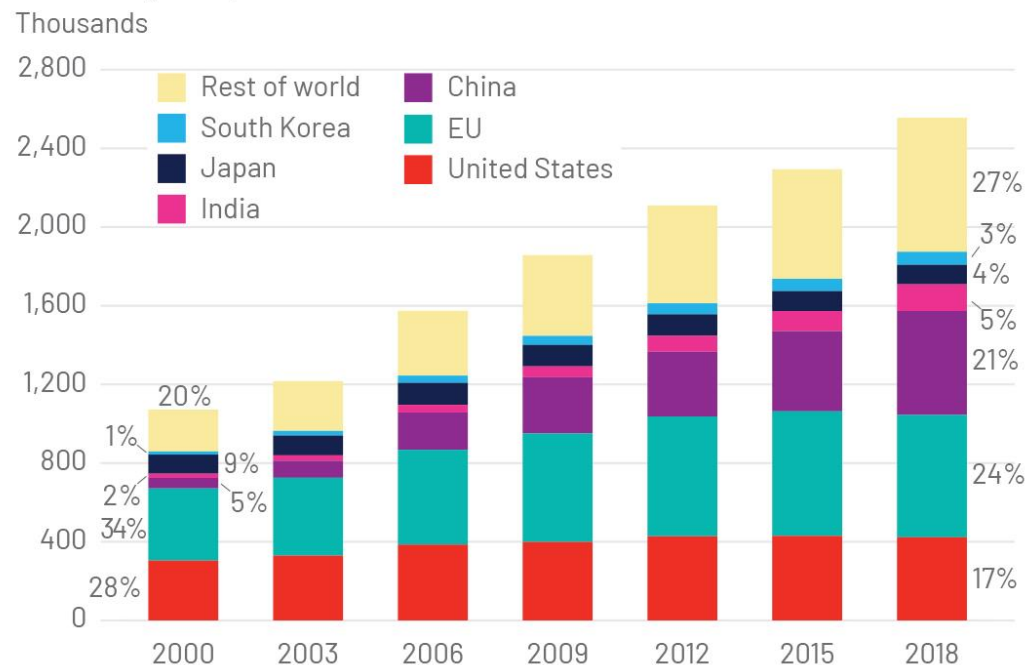
Source: IHS Markit, Comparative Industry Service.





Global S&E Publications

**Figure 21. S&E articles by selected region, country, or economy:
Selected years, 2000-18**



NOTES: Articles are fractionally counted and classified by publication year and assigned to a region, country, or economy by author's institutional address(es). Percentages shown represent share of global S&E articles. See p. 22.

SOURCE: NCSES, special tabulations (2019) of Elsevier's Scopus database.

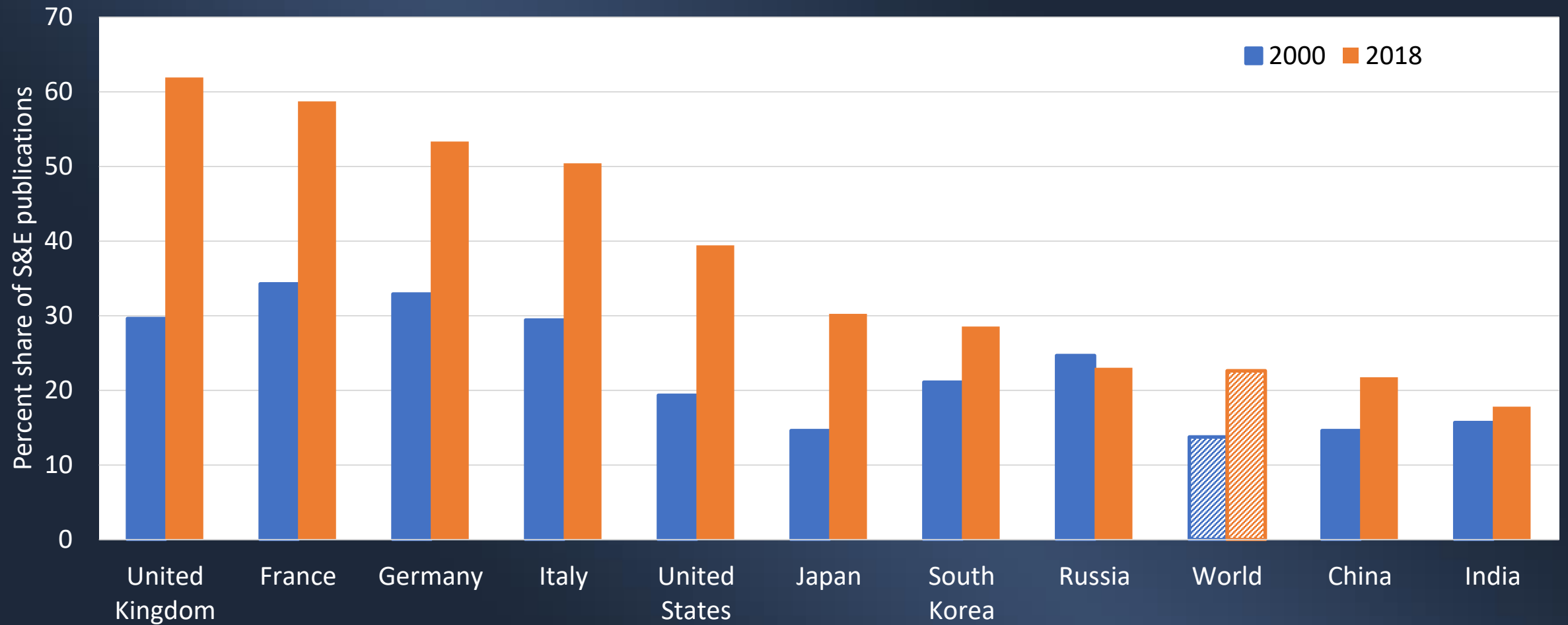
Indicators 2020: Publication Output



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International collaboration on S&E publications



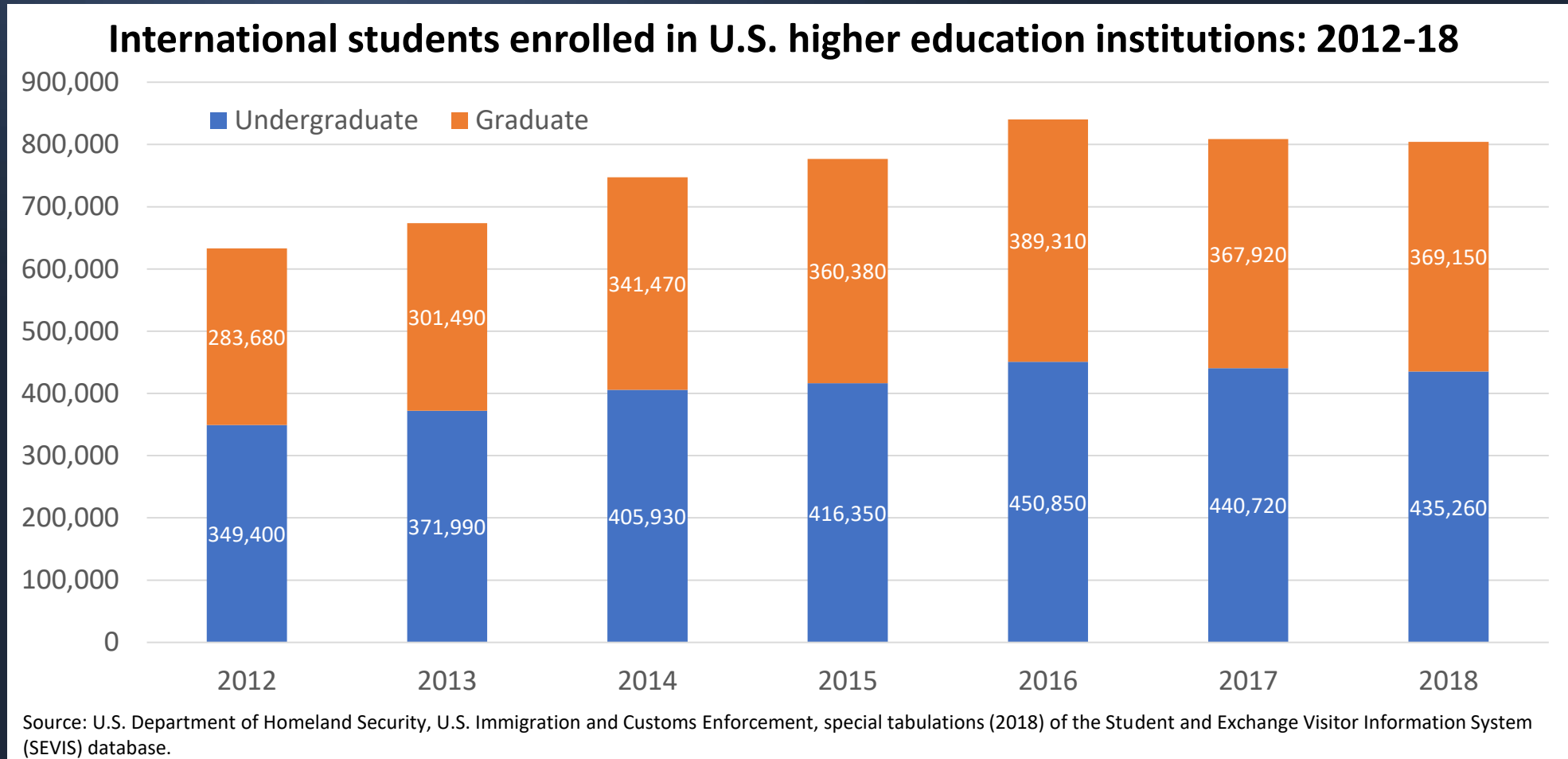
Source: Elsevier, Scopus database.



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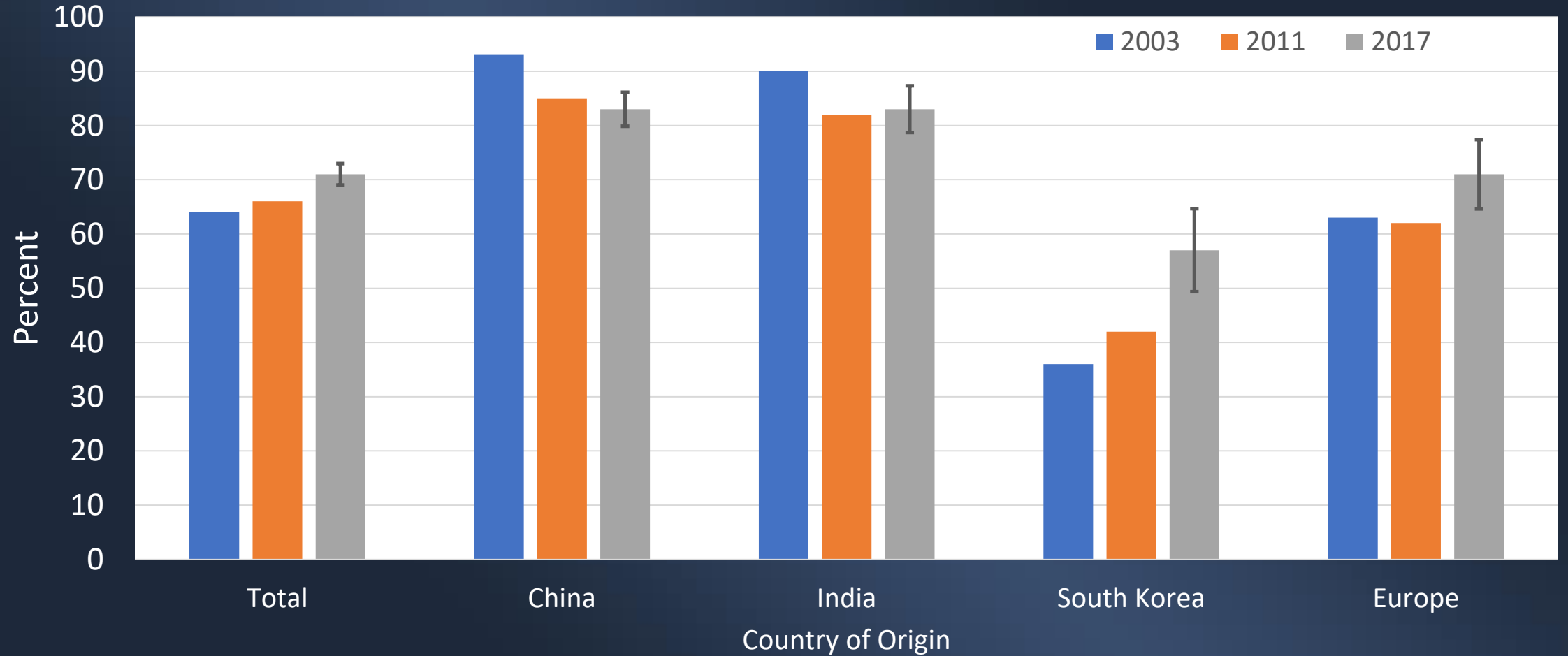
International Student Enrollment



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Stay rate: Foreign Recipients of U.S. S&E Doctorates



Note: The data source changed after 2011. Margin of error is shown for the 2017 estimates which are from a sample survey.

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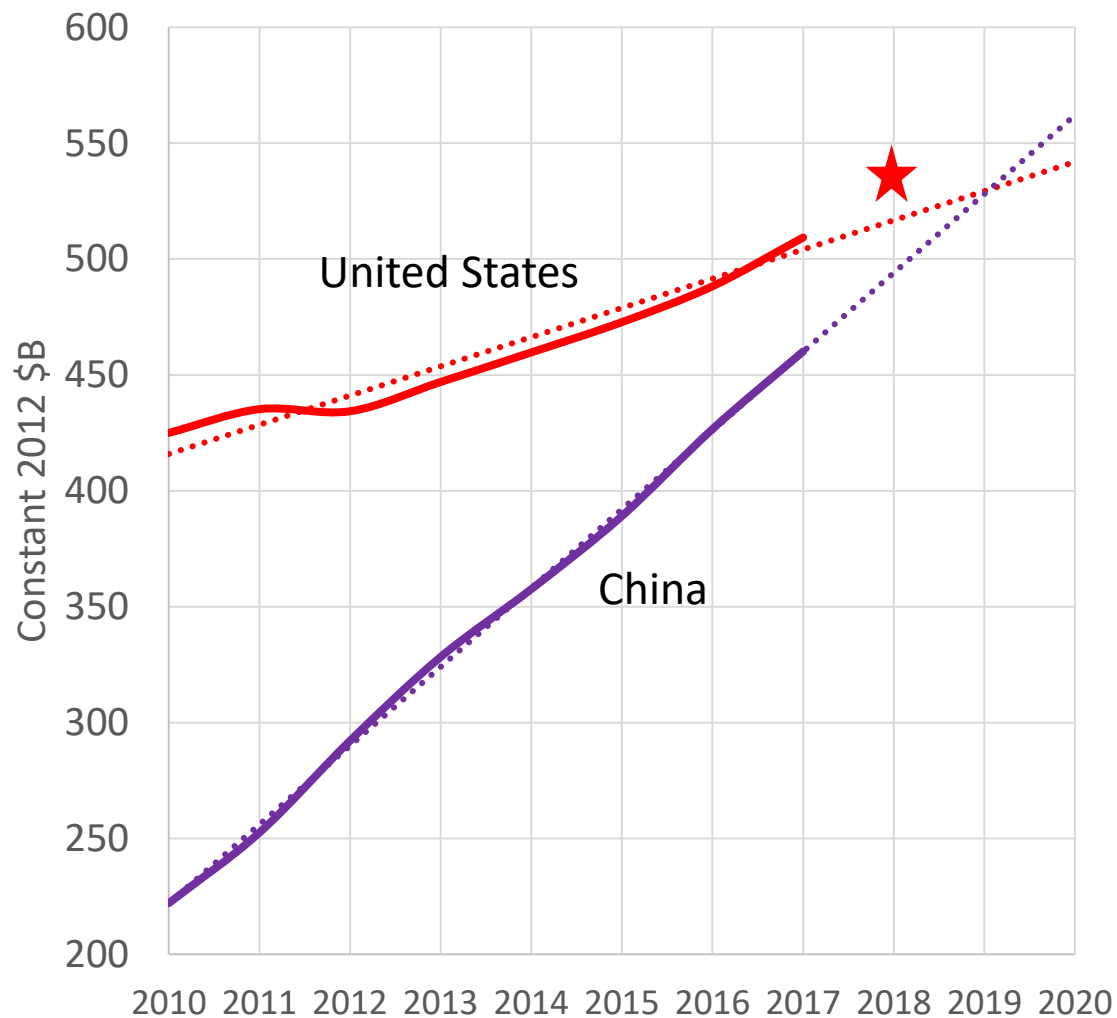




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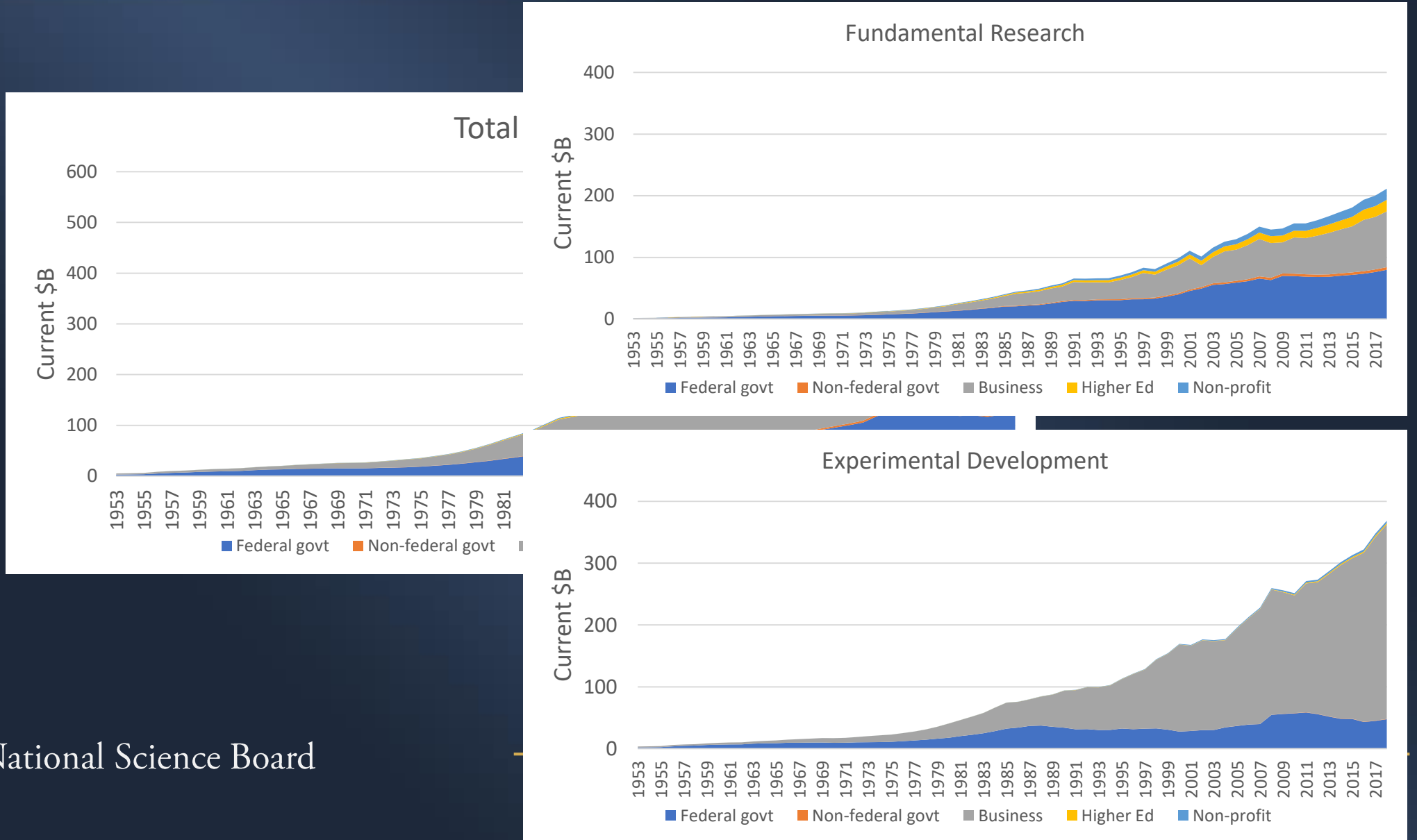
U.S.: We Need to Adapt

Total R&D Expenditures





U.S. Investment in Research & Development



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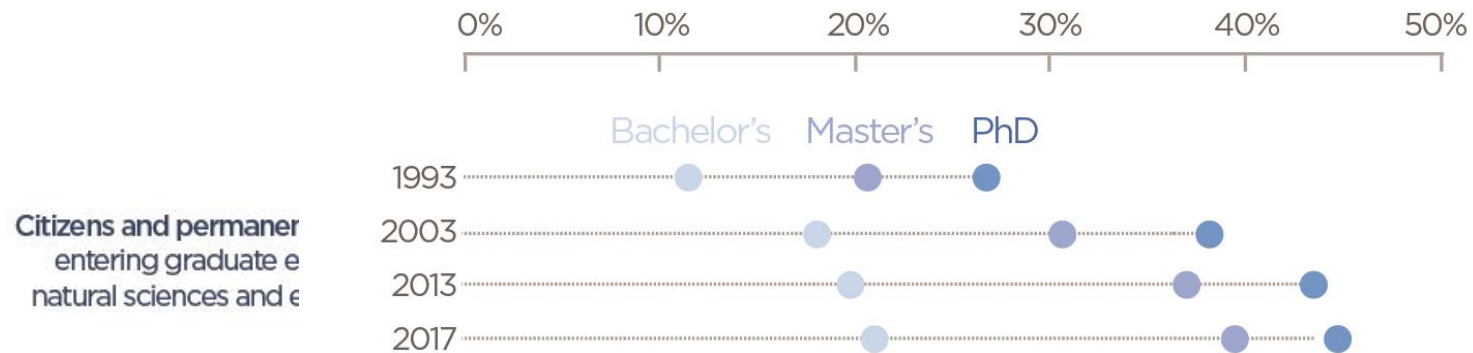
Foreign-born Students & Workers in U.S. S&E



Science & Engineering

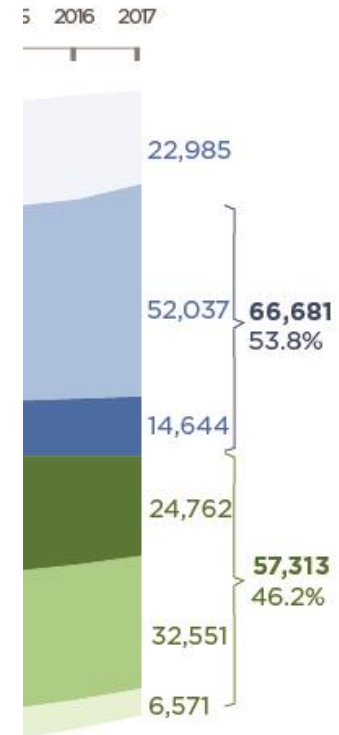
Percent of All Science & Engineering Workers Who are Foreign Born

2000 to 2017

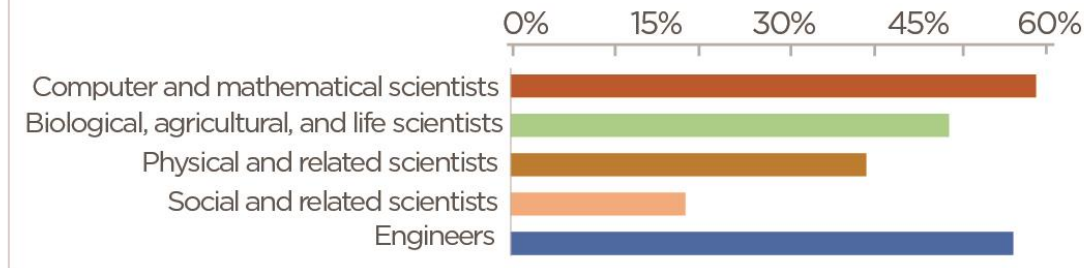


Citizens and permanent residents entering graduate and postgraduate study in natural sciences and engineering

Temporary non-citizens entering graduate and postgraduate study in natural sciences and engineering



Detail: Foreign-Born PhDs Working in S&E Fields (2017)

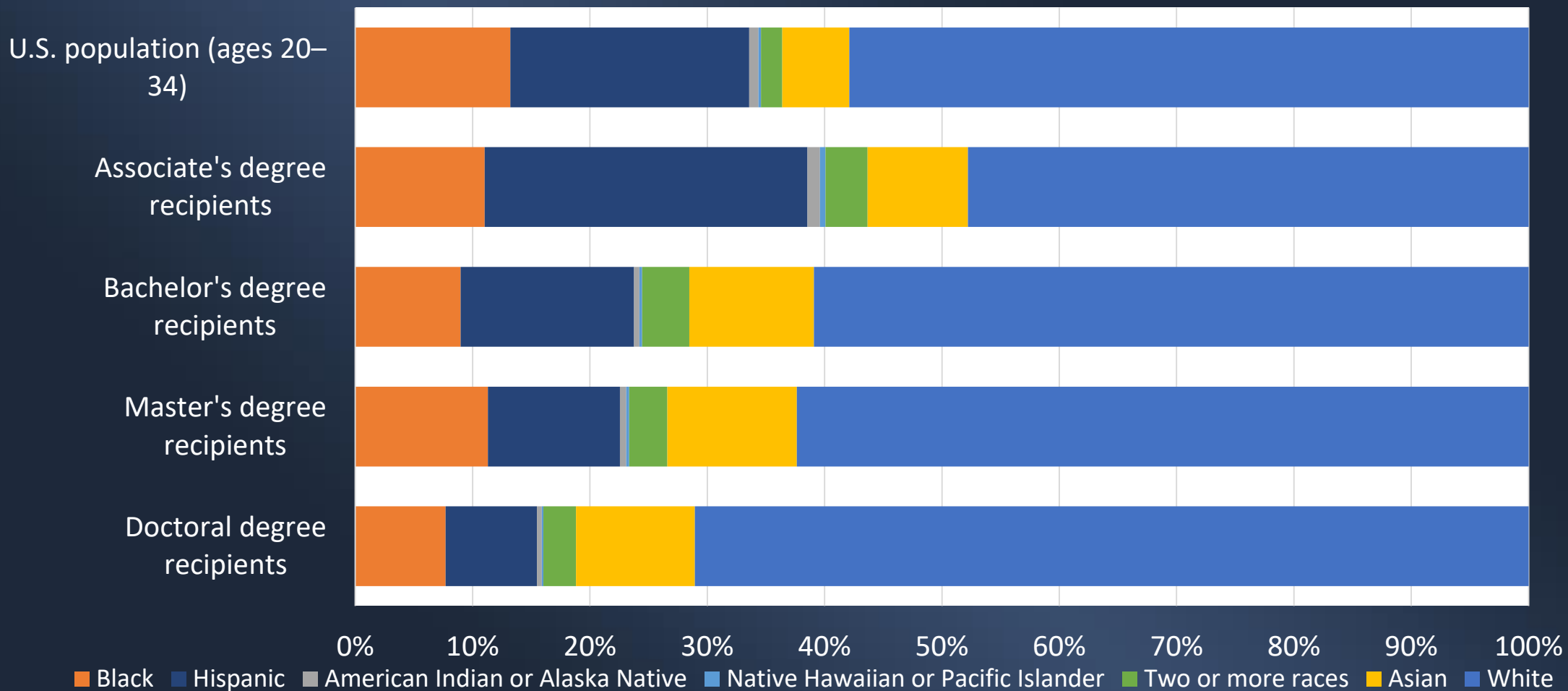


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Race & Ethnicity: U.S. S&E Degree Recipients

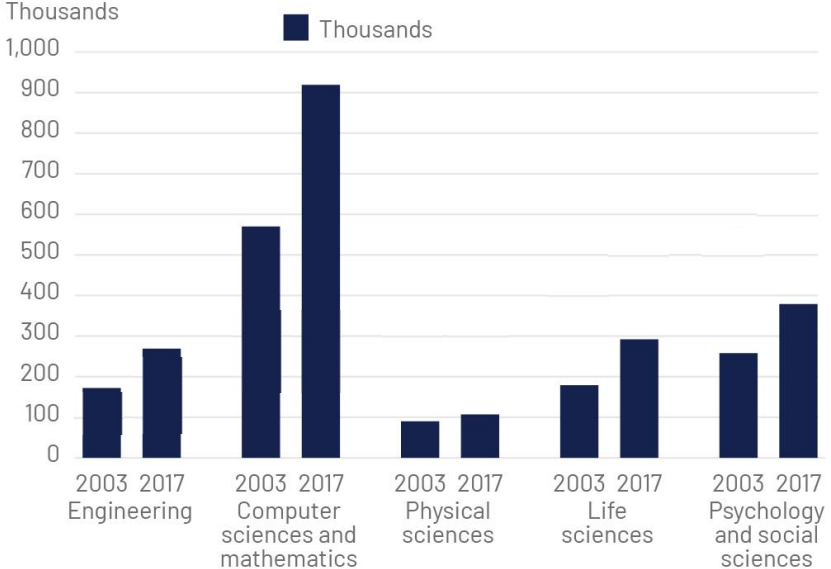


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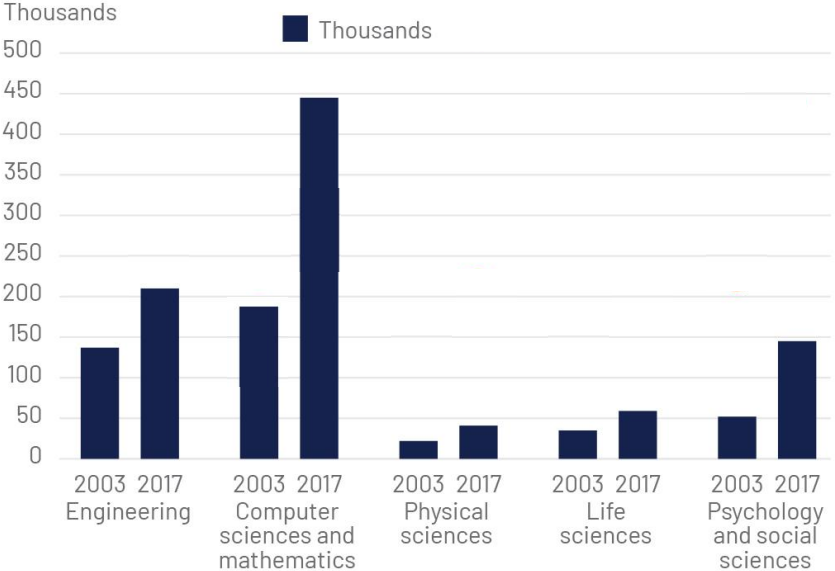
Women & Underrepresented Minorities in U.S. S&E

Figure 7. Women in S&E occupations, by broad occupational category: 2003 and 2017



SOURCES: NCSES, 2003 SESTAT and 2017 NSCG.
Indicators 2020: Labor Force

Figure 8. Underrepresented minorities in S&E occupations, by broad occupational category: 2003 and 2017



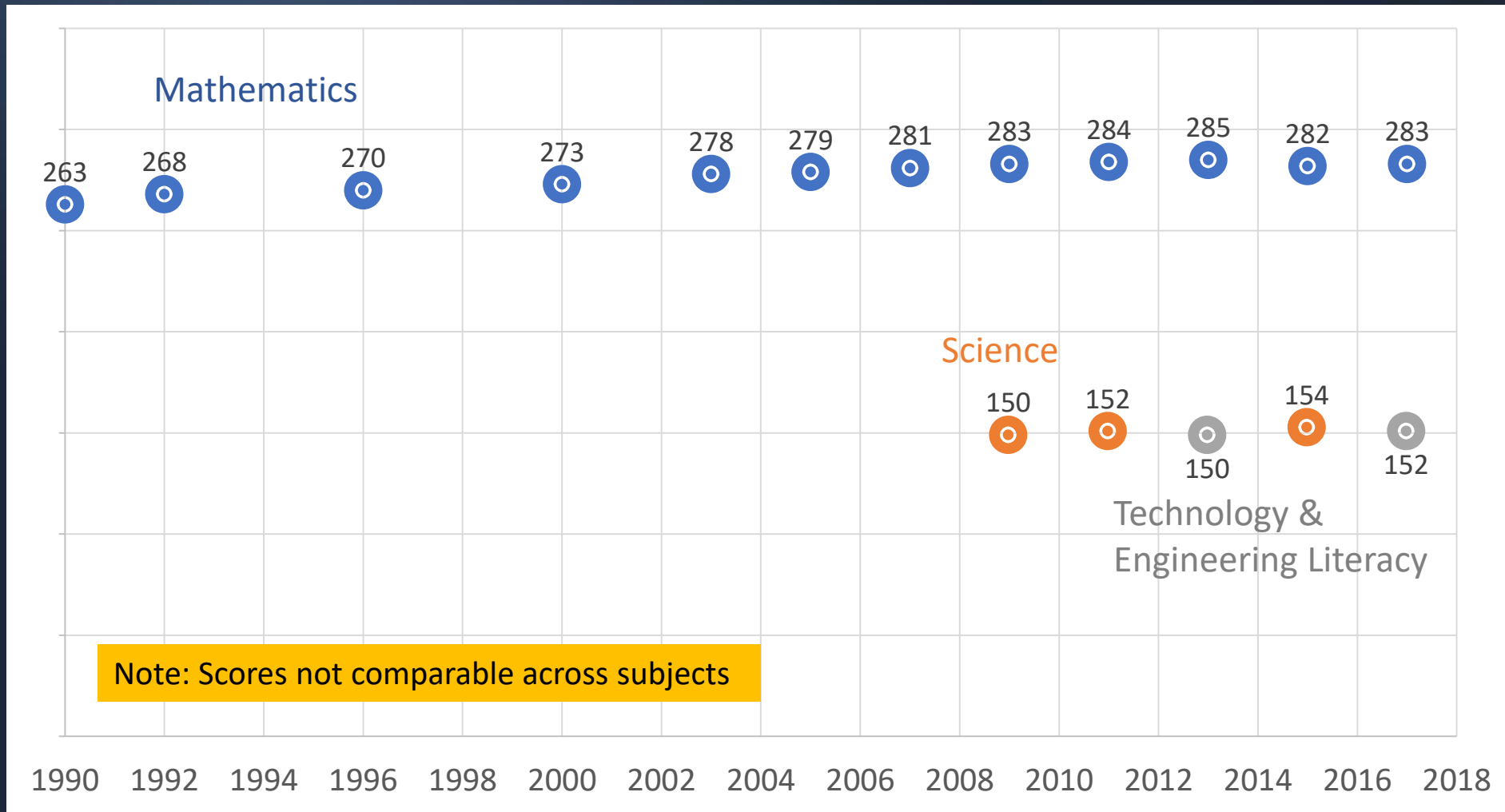
NOTE: Underrepresented minorities includes individuals who are black, Hispanic, or American Indian or Alaska Native.
SOURCES: NCSES, 2003 SESTAT and 2017 NSCG.
Indicators 2020: Labor Force



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U.S. NAEP, Grade 8 Mean scores: 1990-2018



Note: Scores not comparable across subjects



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Risks of Complacency

“There is...the risk a society runs when it falls into the habit of responding to long-term risks with short-term solutions....”

It is the ceding of technical and scientific leadership to China. It is the innovation that never occurs, and the knowledge that is never created, because you have ceased to lay the groundwork for it. It is what you have never learned that might have saved you.”

- Michael Lewis, *The Fifth Risk*



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A Vision for the Future: US Prosperity & Security REQUIRES World-Leading S&E

We must:

- Provide an example to the world in the conduct of science & engineering
- Develop, attract, and retain world-leading talent by:
 - Nurturing all U.S.-born STEM talent
 - Welcoming international talent
- Ensure accessible world-class S&E infrastructure throughout the U.S.
- Partner:
 - Across sectors
 - Across agencies
 - From discovery to market
 - Across the globe



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