

Foreign Graduate Students and the STEM Workforce

Supporting International Students and Researchers in the United States
Government-University-Industry Research Roundtable

March 17, 2021

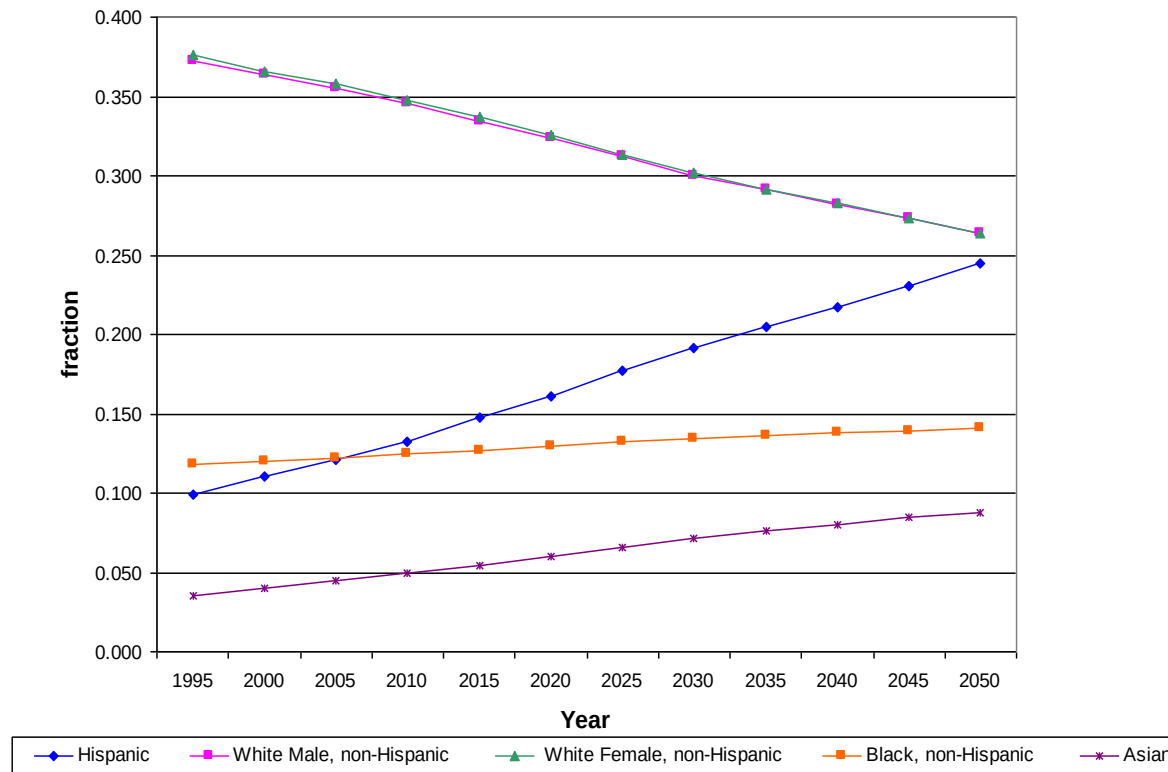
Arthur Bienenstock

STEM Workforce is Critical for the US

- Economy
- National defense
- Health
- Environment
- Food security
-

Bureau of the Census Demographic Projections - 18-64 year olds

Figure 1-3.



Percent of 22 Year Olds Earning Science & Engineering Degrees - 1995

- African-Americans - 5.7
 - Asians - 21.6
 - Hispanic - 4.8
 - non-Hispanic White Females - 11.8
 - non-Hispanic White Males - 13.8
-
- Court decisions and referenda against affirmative action

Projections of Future Situation

- **If** participation rates of all the groups remain the same and demographic projections are correct,
- **then** fraction of workforce that is ST&E will decrease significantly at time when increase is likely to be needed.

Basic Conclusion

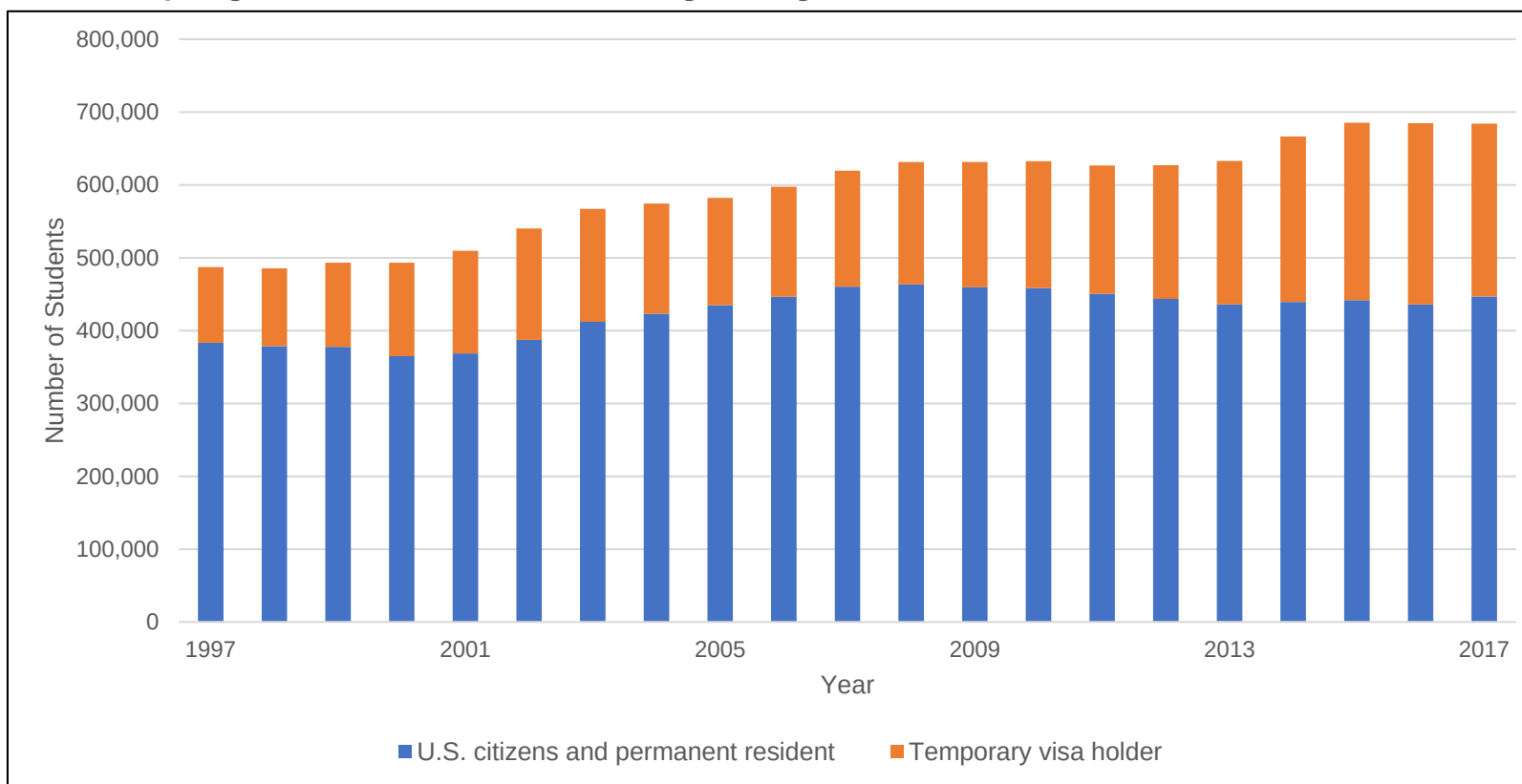
- Must remain attractive for immigration
- Must increase participation rates of all groups in ST&E
- Under-represented minorities, women and persons with disabilities represent largest potential pools

Gap in Supply of STEM Workers

- STEM jobs posted for each unemployed STEM worker
 - 2010 – 5.4
 - 2016 – 13
 - Reference - *Sizing Up the Gap in our Supply of STEM Workers*
 - New American Economy Research Fund – March 29, 2017
- STEM Worker Shortage at a Crisis, Survey Shows
 - U.S. News – August 23, 2018
- ANNUAL REPORT ON THE STATE OF THE DOE NATIONAL LABORATORIES – January, 2017
 - "The Laboratories face several ongoing challenges related to inclusion and diversity, including maintaining critical skills as the Laboratories' workforce ages, particularly in areas that are both core and unique to DOE (e.g., stockpile stewardship and accelerator design), and in training of students, postdoctoral researchers, and staff for the continuing challenges in national security, science, and energy technology."
- **Between 1997 and 2017, US population increased by 23%, but number of domestic graduate students in science, engineering and health fields grew by only 16%. Total of domestic and foreign increased by 40%.**

Foreign students represent 35% of graduate students in science, engineering, and health (SEH) fields

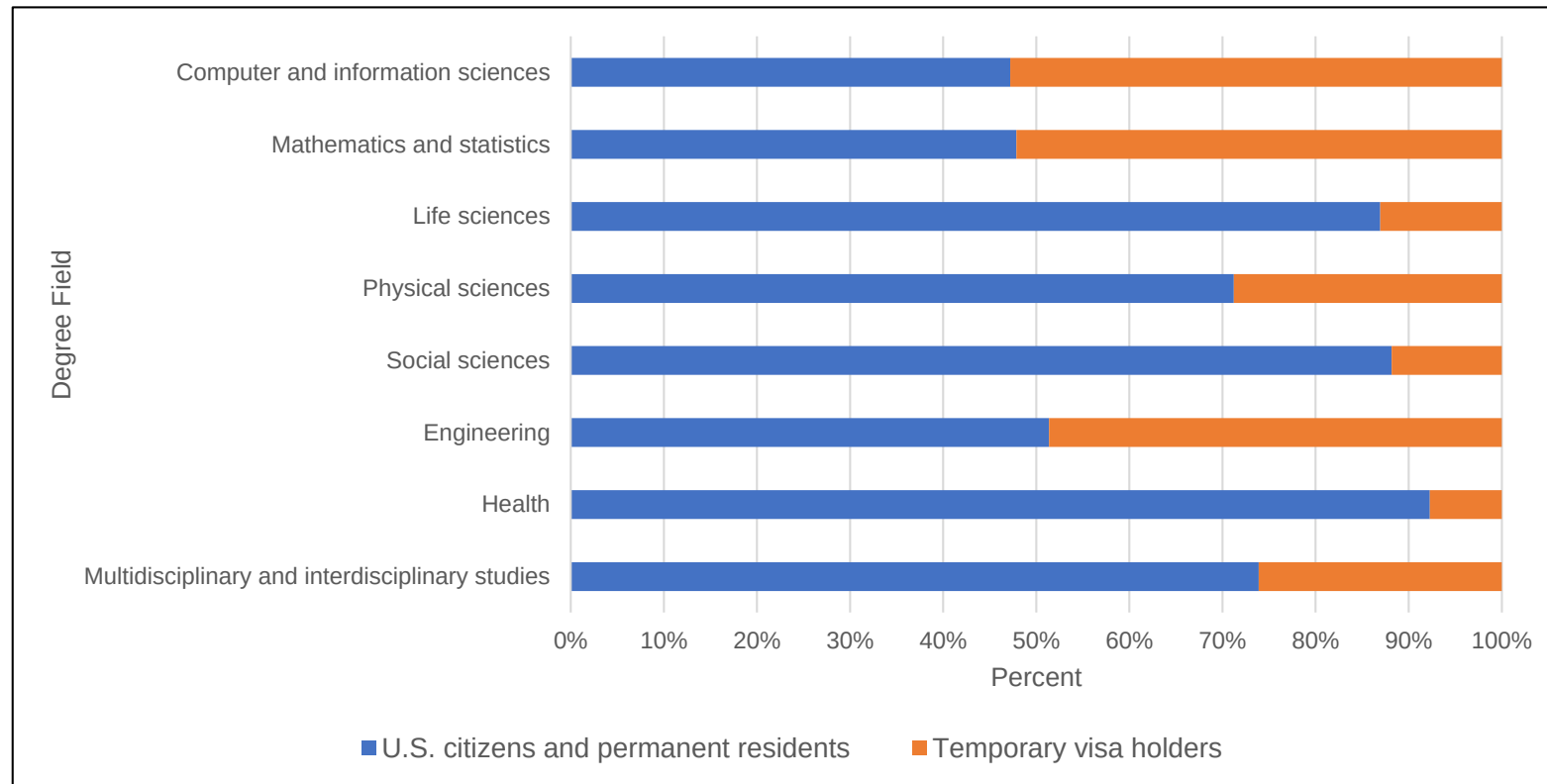
Citizenship of graduate students in science, engineering, and health: 1997–2017



Source: Survey of Graduate Students and Postdoctorates in Science and Engineering: 1997-2017

Foreign students represent over half of the master's degree students in computer science and math, and nearly half of the master's degree students in engineering

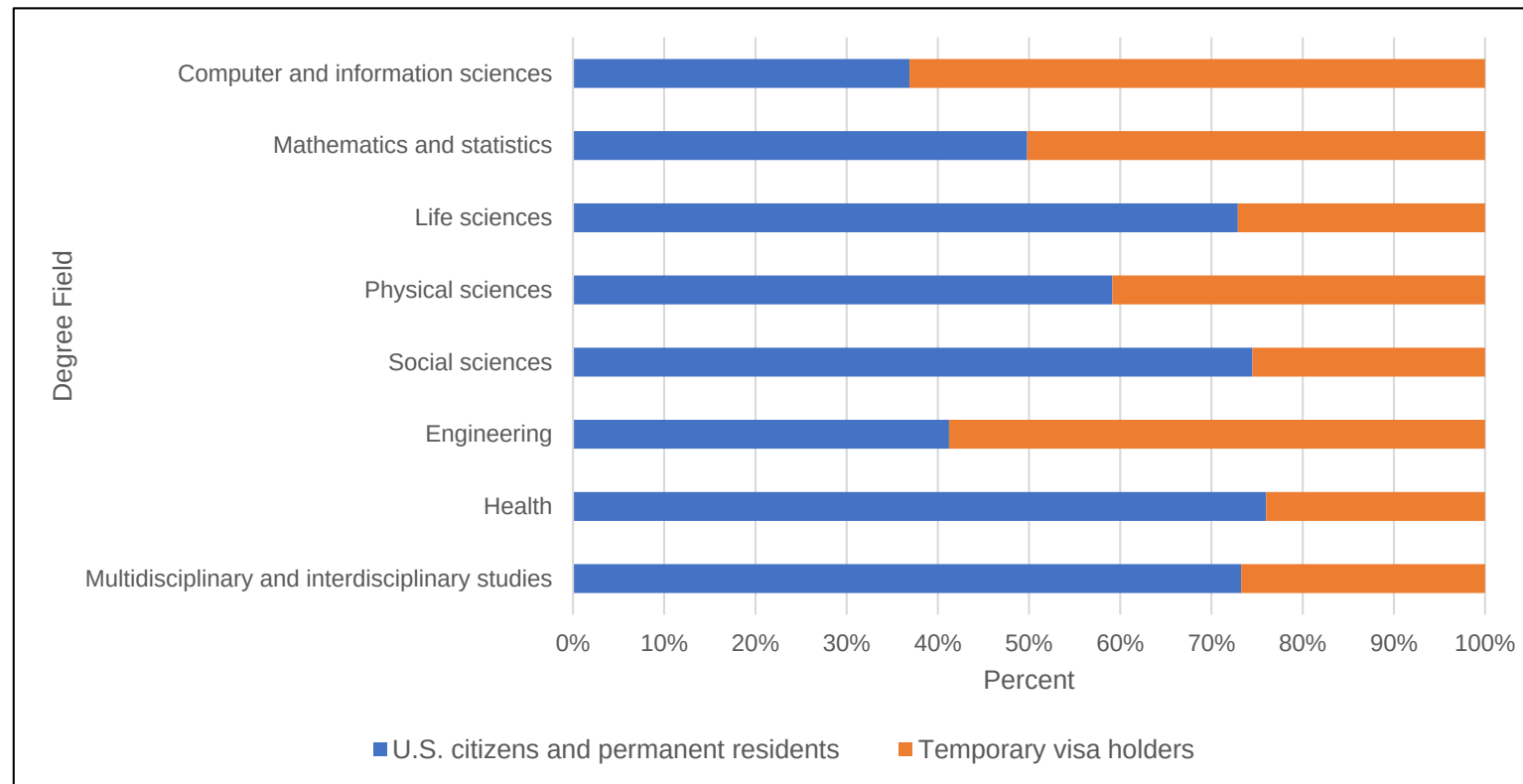
Citizenship of master's degree graduate students by degree field: 2018



Source: Survey of Graduate Students and Postdoctorates in Science and Engineering: 2018

Foreign students represent over half of the doctoral students in computer science, math, and engineering

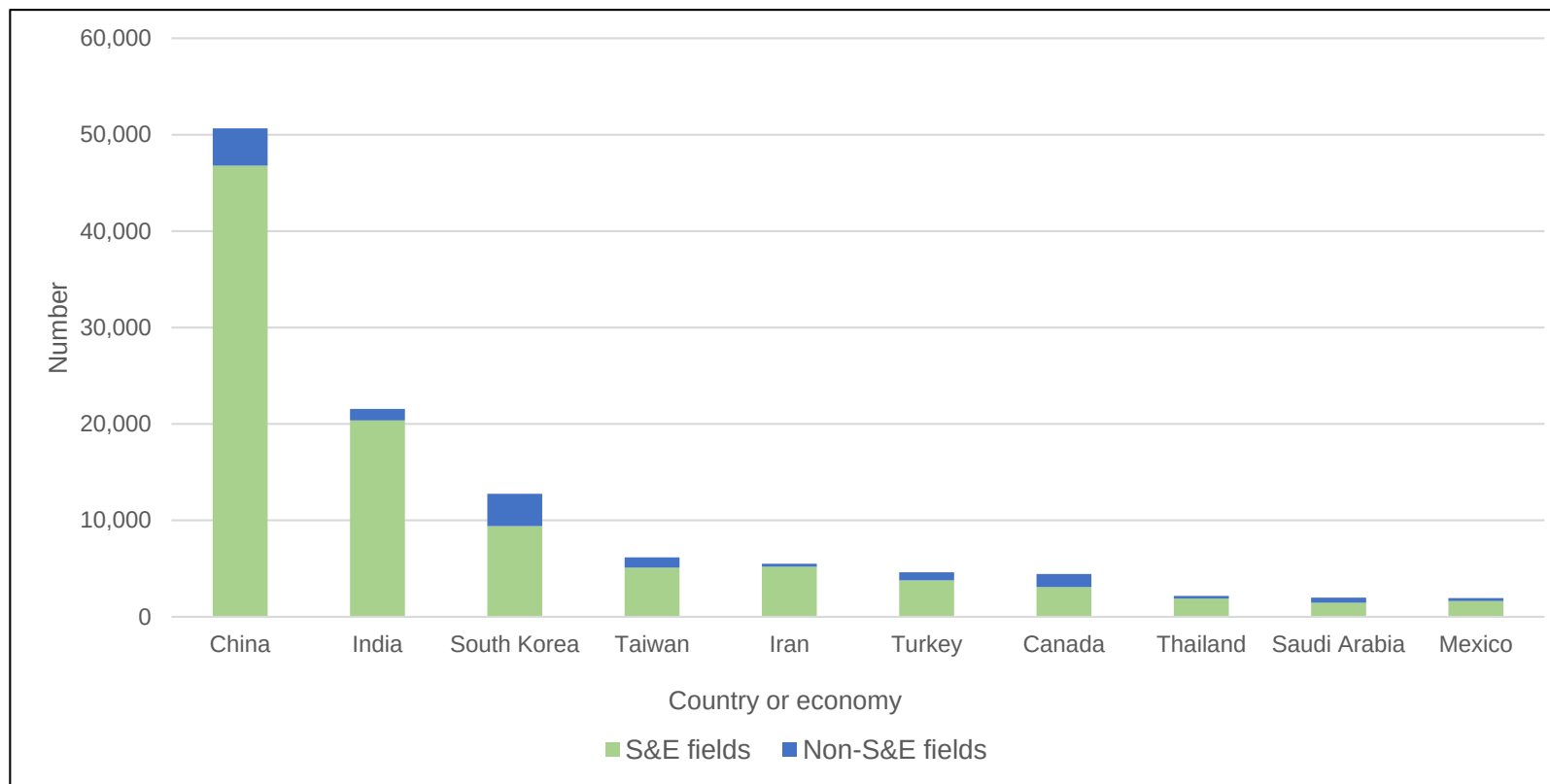
Citizenship of doctoral degree graduate students by degree field: 2018



Source: Survey of Graduate Students and Postdoctorates in Science and Engineering: 2018

In the past decade, three countries accounted for over half (53%) of U.S. doctorates awarded to foreign students

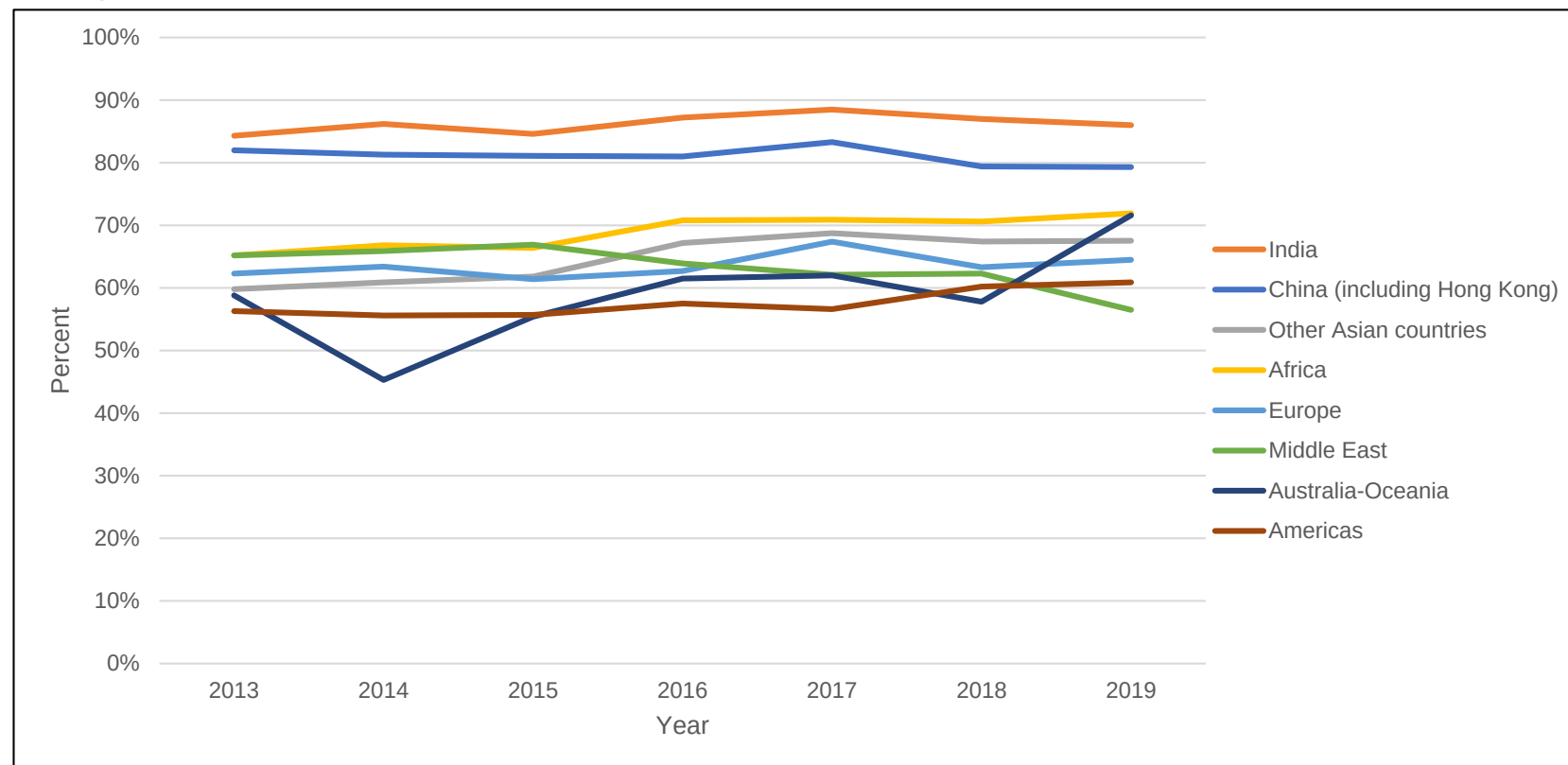
Top 10 countries or economies of foreign citizenship for U.S. doctorate recipients with temporary visas: 2010–19



Source: Survey of Earned Doctorates: 2010-2019

Doctorate postgraduation commitments for U.S. employment varies by country of citizenship

Doctorate recipients with temporary visas intending to stay in the United States after doctorate receipt, by country of citizenship: 2013–19



Source: Survey of Earned Doctorates: 2013-2019

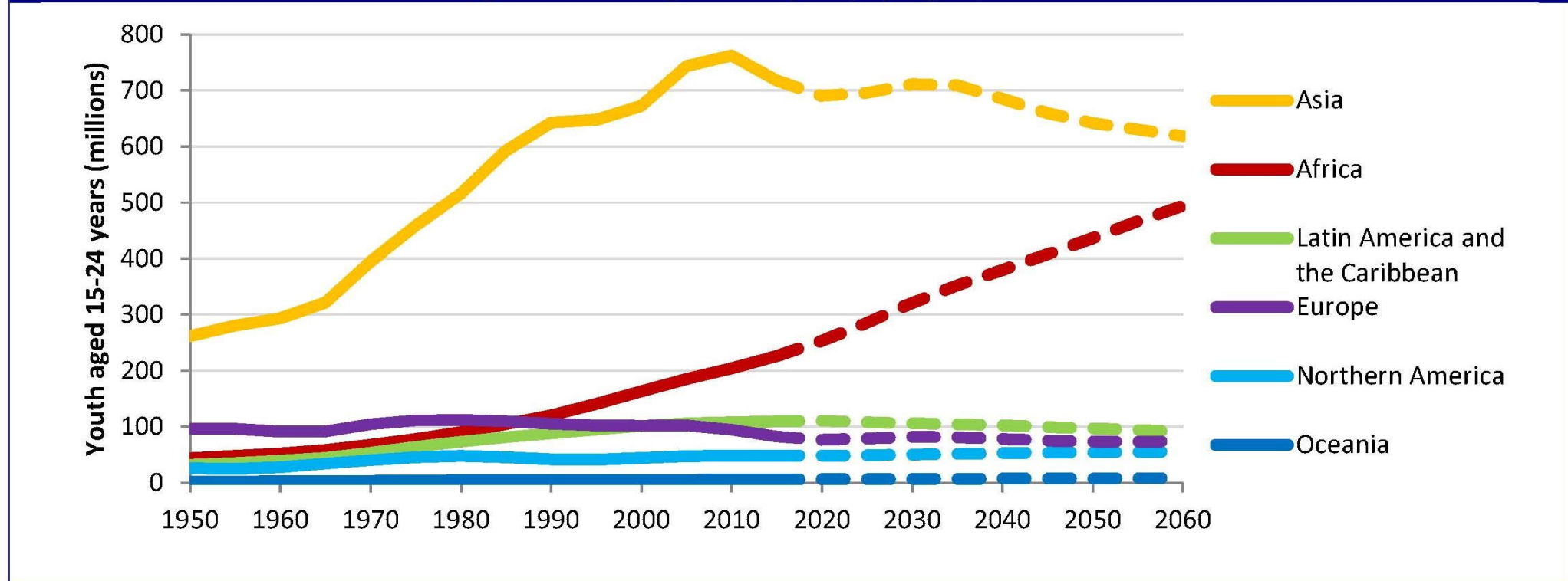
Immigrants Play Major Roles

- On Stanford University's faculty and the on National Science Board, some of the most creative and effective people were born in China or India
- Silicon Valley Index 2020 stated that 67% of all new tech talent in the core working age group (25-44) was Asian.
- Older study determined that immigrant founders started 52 percent of new Silicon Valley companies between 1995 and 2005.

What About the Future?

- Foreign graduate enrollments decline 40% this fall
 - Pandemic
 - 1 year visa makes life difficult for foreign graduate students
 - Hard to return for family matters
- DOE barriers to Chinese students using its facilities
- Senator Cotton – “The United States must bar Chinese graduate and post-graduate students from studying or conducting research in STEM fields that involve sensitive technology.”
- China and India building up their universities and graduate programs
- China and most of developed world is aging and will need its young people
 - Likely to increase attractiveness of remaining home and discourage graduate studies in US
- Where will the young people be?

Figure 1: Youth aged 15-24 years, by region, 1950-2060



Data source: United Nations (2013) *World Population Prospects: The 2012 Revision*.

Conclusions

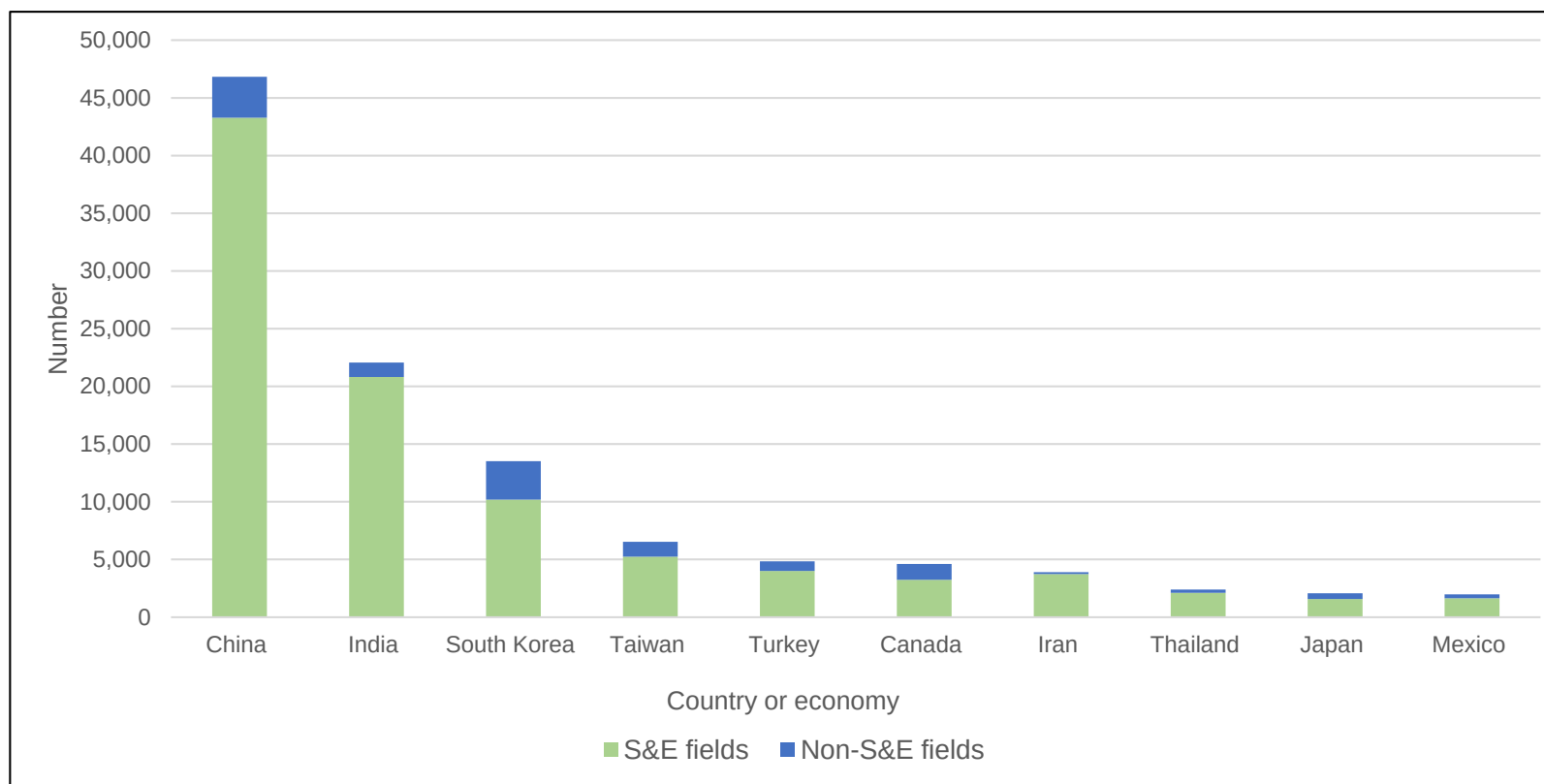
- Must be proactive in making US attractive to foreign students
 - Consider risks and benefits of educating Chinese graduate students
 - >80% stay in US
 - Return to 5 year visas
 - Reduce initiatives that discourage Chinese students from coming
 - Actively encourage students from the Global South, as will have large fraction of young people in coming years
- Increase domestic supply.
 - Reduce financial barriers to domestic students doing graduate STEM studies.

Financial Barriers to Domestic Participation in STEM Graduate Studies

- 2018 Median family incomes -> little chance of saving for college for at least half of population
 - White - \$66K
 - Hispanic - \$51K
 - Black – \$42K
- 2019-20 Public 4-year college cost (tuition, fees, board) - \$22K
- 70% of college graduates have debt averaging \$37K
- Average MBA starting salary after two years study - \$110K
- NIH and NSF postdoc stipends after ~5 years study - <\$60K
- Median asst. prof. salary - \$60,453
- **Must reduce financial barriers to graduate studies**
 - Double Pell grants markedly
 - New NDEA-like program
 - States increase funding of public universities and reduce tuition

Three countries account for over half (54%) of U.S. doctorates awarded to foreign students

Top 10 countries or economies of foreign citizenship for U.S. doctorate recipients with temporary visas: 2008–17

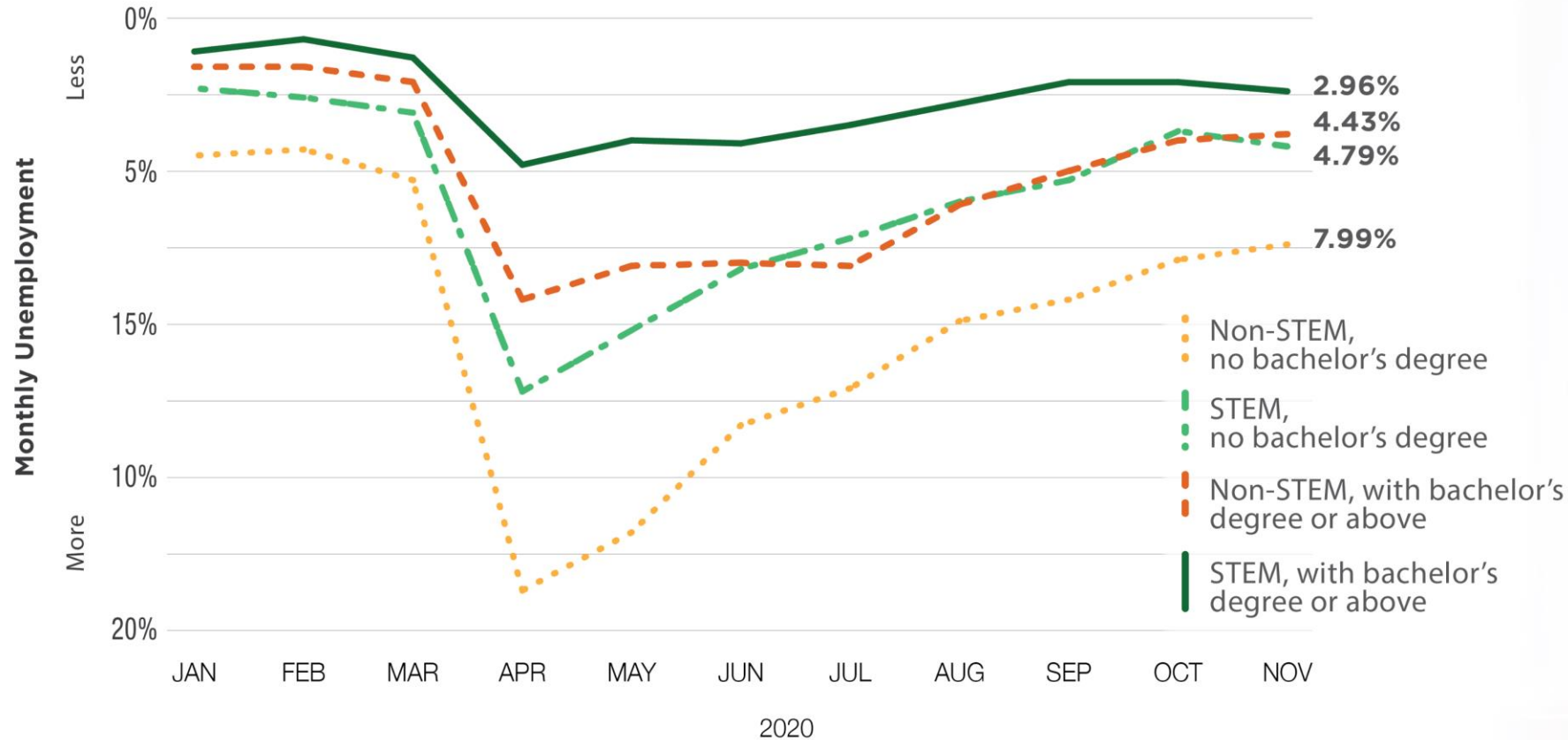


Source: Survey of Earned Doctorates: 2008-2017

The End



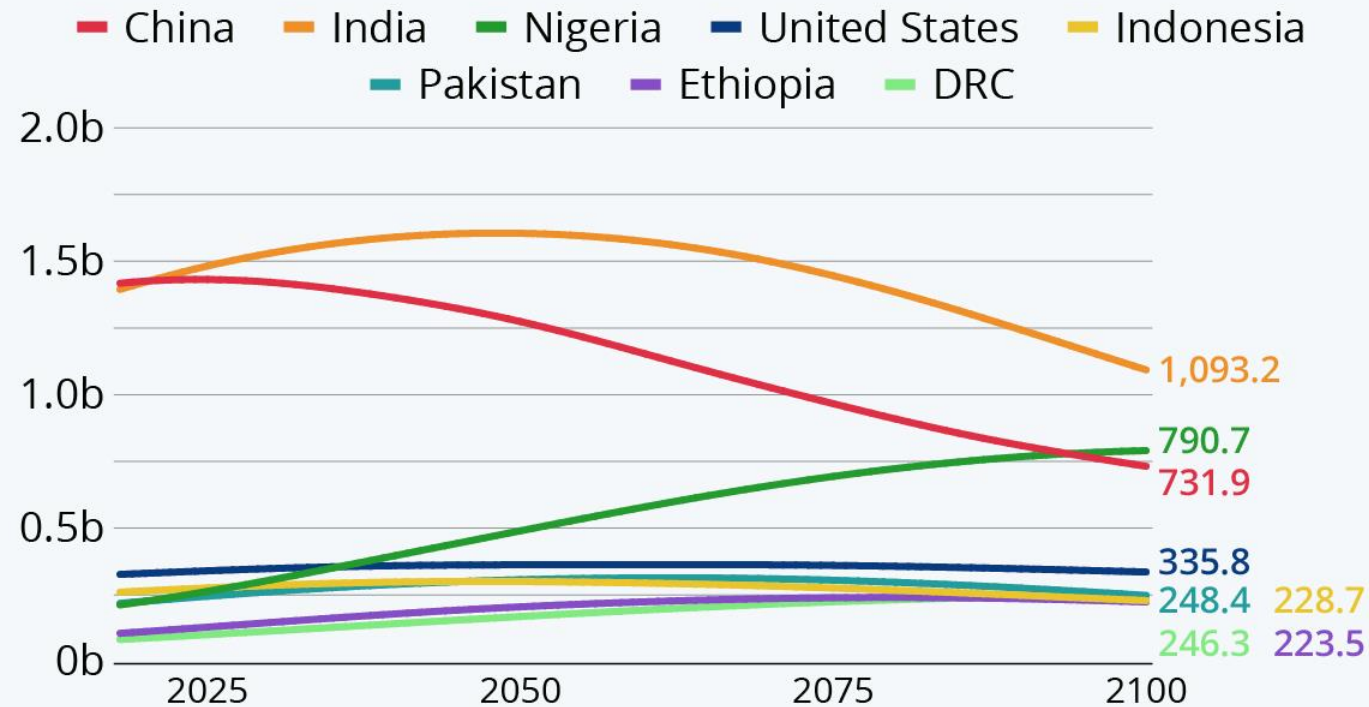
THE STEM WORKFORCE IS RESILIENT, EVEN DURING A GLOBAL PANDEMIC



STEM jobs are resilient. During the pandemic, STEM workers were employed at a higher rate than their non-STEM peers at all education levels. Skilled technical workers who use S&E skills in their jobs but do not have a bachelor's degree were employed on par with non-STEM workers who do have a bachelor's degree or above, even after large initial increases in unemployment. These data illustrate the value of STEM education and skills to all U.S. workers.

Large Population Decline Expected in China and India

Expected size of the population in the most populous countries on Earth* (in millions)



* in the year 2100

Middle estimate

Source: The Lancet



Calculated Fraction of 22 Year Olds Receiving Bachelors Degrees in Science & Engineering if Award Rates of Various Groups Remain Constant

Figure 1-4.

