



Foreign Science and Engineering Presence in U.S. Institutions and the Labor Force

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Summary

The increased presence of foreign students in graduate science and engineering programs and in the scientific workforce has been and continues to be of concern to some in the scientific community. Enrollment of U.S. citizens in graduate science and engineering programs has not kept pace with that of foreign students in those programs. In addition to the number of foreign students in graduate science and engineering programs, a significant number of university faculty in the scientific disciplines are foreign, and foreign doctorates are employed in large numbers by industry.

Few will dispute that U.S. universities and industry have chosen foreign talent to fill many positions. Foreign scientists and engineers serve the needs of industry at the doctorate level and also have been found to serve in major roles at the masters level. However, there are charges that U.S. workers are adversely affected by the entry of foreign scientists and engineers, who reportedly accept lower wages than U.S. citizens would accept in order to enter or remain in the United States.

NSF data reveal that in 2006, the foreign student population earned approximately 36.2% of the doctorate degrees in the sciences and approximately 63.6% of the doctorate degrees in engineering. In 2006, foreign students on temporary resident visas earned 32.0% of the doctorates in the sciences, and 58.6% of the doctorates in engineering. The participation rates in 2005 were 30.8% and 58.4%, respectively. In 2006, permanent resident status students earned 4.2% of the doctorates in both the sciences and in engineering, a slight change from the 2005 levels of 3.8% in the sciences and 4.4% in engineering.

Many in the scientific community maintain that in order to compete with countries that are rapidly expanding their scientific and technological capabilities, the country needs to bring to the United States those whose skills will benefit society and will enable us to compete in the new-technology based global economy. The academic community is concerned that the more stringent visa requirements for foreign students may have a continued impact on enrollments in colleges and universities. There are those who believe that the underlying problem of foreign students in graduate science and engineering programs is not necessarily that there are too many foreign-born students, but that there are not enough native-born students pursuing scientific and technical disciplines.

Legislation has been introduced in the 111th Congress to attract foreign students in the scientific and technical disciplines and to maintain the interests of American scientists. H.R. 4321, Comprehensive Immigration Reform for America's Security and Prosperity Act, would, among other things, amend H-1B visa employer application requirements by lengthening U.S. worker protection and prohibiting employer position announcements that specify positions solely to, or give priority to, H-1B visa holders. H.R. 1791, Stopping Trained in America Ph.D.s from Leaving the Economy Act (STAPLE), would place numerical limitations on immigrants who have been awarded a doctorate degree in the scientific disciplines from a U.S. institution and who have an offer of employment from a U.S. employer in a degree-related field.

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The increased presence of foreign students in graduate science and engineering programs and in the scientific workforce has been and continues to be of concern to some in the scientific community.¹ Enrollment of U.S. citizens in graduate science and engineering programs has not kept pace with that of foreign students in those programs.² In addition to the number of foreign students in graduate science and engineering programs, a significant number of university faculty in the scientific disciplines are foreign, and foreign doctorates are employed in large numbers by industry.

Those in the scientific community, arguing for ceilings on admissions for immigrants, maintain that foreign students use U.S. graduate education programs as stepping stones to immigration through sponsorships for legal permanent residence.³ Approximately 56% of foreign doctorate degree earners on temporary visas remain in the United States, with many eventually becoming citizens.⁴ Data on adjustments from temporary visas to permanent status reveal that approximately 6 in 10 new permanent residents occurred in both 2007 and 2008 from adjustments of status admissions.⁵ In 2008, approximately 15.0% of those individuals awarded legal permanent resident status resulted from employment-based preferences.

Few will dispute that U.S. universities and industry have chosen foreign talent to fill many positions.⁶ Foreign scientists and engineers serve the needs of industry at the doctorate level and also have been found to serve in major roles at the masters level.⁷ Not surprisingly, there are

¹ This report excludes the discussion of foreign students entering the medical profession. For a general discussion of foreign students in the United States in all disciplines, see for example, CRS Report RL31146, *Foreign Students in the United States: Policies and Legislation*, by (name redacted).

² National Science Foundation, First-Time, Full-Time Graduate Student Enrollment in Science and Engineering Increases in 2006, Especially Among Foreign Students, NSF08-302, InfoBrief, Arlington, VA, December 2007, 6 pp., and McCormack, Eugene, "Number of Foreign Students Bounces Back to Near-Record High," *The Chronicle of Higher Education*, v. 54, November 16, 2007, p. A1.

³ An employer may sponsor a foreign scientist or engineer for legal permanent residence, if they meet terms established by the Immigration and Nationality Act.

⁴ Foreign students planning to remain in the United States following graduation vary by field and discipline as well as by country of origin. For all science and engineering fields, the stay rate is 56%; for physical sciences, 64%; life sciences, 63%; mathematics, 57%; computer sciences, 63%; and agricultural sciences, 38%. Stay rates are not static, and various estimates appear in the literature. Differences are observed over a period of time in the main country of origin for foreign scientists and engineers. (It has been estimated that Chinese and Indian students who choose to remain in the United States following their studies range from 66% to 92% and 77% to 88%, respectively). The stay rates of foreign students have an impact on both the U.S. economy and the supply of scientific personnel in the United States and on the economies of the home countries of the foreign students. Michael G., *Stay Rates of Foreign Doctorate Recipients from U.S. Universities, 2005*, Science and Engineering Education, Oak Ridge Institute for Science and Education, 2007, 20 pp.

⁵ It should be noted that both the number of applications filed and the number of petitions awaiting a decision on adjustment of status declined from 2007 to 2008. Homeland Security, Office of Immigration Statistics, Annual Flow Report, *U.S. Legal Permanent Residents:2008*, by Randall Monger and Nancy Rytina, Washington, DC, March 2009, pp. 2-3.

⁶ It is estimated that in colleges and universities, foreign-born doctorate degree holders account for approximately 33% of the full-time faculty in computer sciences, 26% in engineering, 33% in mathematics, and 22% in the physical sciences. At the postdoctoral level, the participation of foreign doctorate holders is 56% in engineering, 50% in mathematics, and 42% in physical sciences. Data show that since 1990, approximately 50% of the U.S. Nobel laureates in the scientific and technical disciplines were foreign-born. *Science and Engineering Indicators 2004*, Volume 2, Appendix Table 5-25.

⁷ See for example The National Academies, Committee on Science, Engineering, and Public Policy, *Policy Implications of International Graduate Students and Postdoctoral Scholars in the United States*, Washington, DC, May 2005, pp. 17-65.

charges that U.S. workers are adversely affected by the entry of foreign scientists and engineers, who reportedly accept lower wages than U.S. citizens would accept in order to enter or remain in the United States.⁸ These arguments occur in the context of a debate on projections and potential imbalances in certain scientific and technical disciplines.⁹ The U.S. Bureau of Labor Statistics reports that between the years 2006 and 2016, employment in science and engineering fields will increase at a faster rate than other professional groups. The growth rate will result, primarily, from growth in mathematics and computer-related occupations.¹⁰

Much attention in the scientific community has focused on the H-1B temporary admissions program.¹¹ A report of the National Science Foundation (NSF) during the late 1980s claiming a nationwide shortage of scientists and engineers may have contributed to the decision by Congress to expand the skilled-labor preference system contained in the Immigration Act of 1990.¹² The 1990 legislation more than doubled employment-based immigration, including scientists and engineers entering under the H-1B visa category. The act raised the numerical limits or ceilings on permanent, employment-based admissions, from 54,000 to 140,000 annually.¹³ In addition, the legislation ascribed high priority to the entry of selected skilled and professional workers, and simplified admissions procedures for foreign nationals seeking to temporarily work, study, or conduct business in the United States.

On October 17, 2000, the American Competitiveness in the Twenty-First Century Act of 2000 was signed into law (P.L. 106-313), significantly changing the H-1B program and the employment-based immigration program. The legislation raised the annual number of H-1B visas to 195,000 for FY2001, FY2002, and FY2003, and returned to 65,000 in FY2004. It excluded from the new ceiling all H-1B nonimmigrants who are employed by institutions of higher education and nonprofit or governmental research organizations. The law authorized additional

⁸ Center for Immigration Studies, Davis, Donald R. and David E. Weinstein, *United States Technological Superiority and the Losses From Migration*, February 2005, 7 pp.

⁹ The National Academy of Sciences, Committee on Science, Engineering, and Public Policy, *Rising Above the Gathering Storm*, Washington, 2005, pp. 3-1 - 3-31, Monastersky, Richard, "Is There a Science Crisis? Maybe Not," *The Chronicle of Higher Education*, v. 50, July 9, 2004, p. A10, and Jackson, Shirley Ann, *Envisioning a 21st Century Science and Engineering Workforce for the United States*, Report to the Government-University-Industry Research Roundtable, Washington, DC, 2003, 18 pp.

¹⁰ Hecker, Daniel E., "Occupational Employment Projections to 2016," *Monthly Labor Review*, November 2007, p. 90.

¹¹ The H-1B visa category was established by the Immigration Act of 1990. The Immigration Act and the American Competitiveness and Workforce Improvement Act of 1998 regulate H-1B policy and guide H-1B procedures. The H-1B temporary visa category allows the foreign professional to work in the United States in specialty occupations for a period up to six years (generally in three-year increments). Typically the specialty occupation includes positions such as scientists, engineers, teachers, computer programmers, medical doctors, and physical therapists. The application for H-1B status must be filed by an employer; an individual cannot obtain an H-1B visa on his or her own. Employers of H-1B workers are required to meet certain labor conditions, including paying comparable wages. The requirements are designed to ensure that U.S. workers are not negatively impacted by nonimmigrant workers. For expanded discussion of the H-1B visa see CRS Report RL30498, *Immigration: Legislative Issues on Nonimmigrant Professional Specialty (H-1B) Workers*, by (name redacted), and Usdansky, Margaret L. and Thomas J. Espenshade, *The H-1B Visa Debate in Historical Perspective: The Evolution of U.S. Policy Toward Foreign-Born Workers*, Working Paper No. 11, The Center for Comparative Immigration Studies, University of California-San Diego, May 10, 2000, 11pp.

¹² The shortage of technical workers that was projected and used to justify the significant increase in employment-based immigration authorized by the 1990 Immigration Act never materialized. The projections were determined to be erroneous because of flawed data and faulty methodology. Mervis, Jeffrey, "Congress Presses Probe Into NSF Prediction of Scientist Shortage," *The Scientist*, v. 5, October 28, 1991, pp. 1, 6-7.

¹³ Immigration to the United States occurs in three ways: (1) legal, including family- and employment-based immigration; (2) humanitarian, which includes refugees and/or asylum seekers; and (3) illegal.

H-1B visas for FY1999 to offset the visas inadvertently approved for the year that exceeded the cap.¹⁴ In addition, the law increased the fees employers paid for each petition for nonimmigrant status—from \$500 to \$1,000 per petition.¹⁵ A portion of the fees were made available to the NSF for the development of private-public partnerships in K-12 education, the expansion of computer science, engineering, and mathematics scholarships, and the establishment of demonstration programs or projects that provide technical skills training for U.S. workers, both employed and unemployed.¹⁶

Signed into law on December 8, 2004, P.L. 108-447, The Consolidated Appropriations Act, 2005, reauthorized H-1B funding.¹⁷ The fee employers pay for each petition was raised from \$1,000 to \$1,500 per petition. For employers with less than 25 full-time equivalent employees, the fee was set at \$750 per petition. Also, the legislation created an additional 20,000 H-1B visas for FY2005, for those who had earned a masters degree or higher from a U.S. institution of higher education.¹⁸

The scientific community has been divided over proposals to impose stricter immigration limits on people with scientific and technical skills. Attempts to settle upon the balance between the needs for a highly skilled scientific and technical workforce, and the need to protect and ensure job opportunities, salaries, and working conditions of U.S. scientific personnel, will continue to be debated. This paper addresses these issues.

Foreign Students in U.S. Institutions¹⁹

The number of non-U.S. citizens enrolling in U.S. colleges and universities slowed following the September 11th terrorist attacks.²⁰ The slowing of enrollments has been attributed to, among other

¹⁴ The then Immigration and Naturalization Service acknowledged that in the fall of 1999, problems with the computerized tracking system lead to the approval of between 21,888 and 23,385 more H-1B visas allowable for FY1999. See for example General Accounting Office, *H-1B Foreign Workers: Better Controls Needed to Help Employers and Protect Workers*, GAO/HEHS-00-157, Washington, DC, September 2000, pp. 28-29.

¹⁵ The law expanded the list of employers who are exempt from paying the fee. For expanded discussion of the H-1B specialty worker see General Accounting Office, *Grants from H-1B Visa Fees Meet Specific Workforce Needs, But At Varying Skill Levels*, GAO-02-881, Washington, DC, September 2002, 78 pp.

¹⁶ In addition, the Department of Labor (DOL) received fees for job training, scholarships, and grants. The fees had sunset on October 1, 2003.

¹⁷ Title IV, Subtitle B: H-1B Visa Reform.

¹⁸ The first 20,000 H-1B beneficiaries with an earned master's degree or higher from a U.S. institution are exempt from the annual congressional mandated H-1B visa cap of 65,000. In addition, the legislation modified the formula for allocating fees from the H-1B Nonimmigrant Petitioner Account. See U.S. Department of Homeland Security, U.S. Citizenship and Immigration Services, Press Release, "USCIS to Implement H-1B Visa Reform Act of 2004," December 9, 2004, 2pp. Citizenship and Immigration Services began taking applications for the 20,000 H-1B visa workers with advanced degrees on May 12, two months behind schedule. The USCIS stated that the delay in implementation of the expanded H-1B visa program resulted from a need for clarification and interpretation of the law. NOTE: The USCIS exceeded the 65,000 cap on H-1B visas by approving 10,000 more petitions for visas than were authorized by Congress.

¹⁹ For expanded discussion of foreign science and engineering students in U.S. institutions please see National Science Foundation, "Foreign Science and Engineering Students in the United States," *InfoBrief*, by Joan Burrelli, NSF10-324, Arlington, VA, July 2010, 8 pp.

²⁰ See for example Jaschik, Scott, "International Recovery," *Inside Higher Ed*, November 13, 2006, <http://insidehighered.com/news/2006/11/13/intl>; McCormack, Eugene, "Foreign Applications to Graduate Schools Rise After 2-Year Drop," *The Chronicle of Higher Education*, v. 52, March 31, 2006; Bhattacharjee, Yudhijit, "Drop in Foreign Application Slows," *Science*, v. 307, March 18, 2005, p. 1706; and *Policy Implications of International* (continued...)

things, the tightening of U.S. visa policies and increased global competition for graduates in the scientific and technical disciplines from countries such as China, India, and Canada.²¹ However, a 2009 report of the Institute of International Education reveals that for the academic year 2008-2009, the number of foreign-born students (in all disciplines) increased by 8.0%, the largest recorded increase since 1980.²² The growth of students from China contributed significantly to the increase.²³ In addition, new foreign student enrollment for 2008-2009 increased by approximately 16.0% from the previous academic year. The new enrollments are said to result from both recruitment efforts by U.S. institutions and recently improved visa processing for students.²⁴ The international student enrollment changes are reflected differently by types of institutions, levels of study, and disciplines.

There are noticeable differences by world region of origin in the flow of foreign students to the United States. India's students were 15.4% of the population for academic year 2008-2009. The other countries of origin of foreign students falling within the top ten were China (14.6%), South Korea (11.2%), Canada (4.4%), Japan (4.4%), Taiwan (4.2%), Mexico (2.2%), Turkey (2.0%), Vietnam, (1.9%), and Saudi Arabia (1.9%). The top ten fields of study for all foreign students were: business and management (20.6%), engineering (17.7%), physical and life sciences (9.2%), social sciences (8.5%), mathematics and computer sciences (8.4%), health professions (5.2%), fine and applied arts (5.2%), intensive English language (4.2%), humanities (2.9%), education (2.7%), and agriculture (1.3%).²⁵

Participation Rates in Science and Engineering

NSF data reveal that in 2006, the foreign student population earned approximately 36.2% of the doctorate degrees in the sciences and approximately 63.6% of the doctorate degrees in

(...continued)

Graduate Students and Postdoctoral Scholars in the United States, pp. 17-34.

²¹ See for example Fischer, Karin, "Foreign-Student Enrollments in U.S. Rise Despite Global Recession," *The Chronicle of Higher Education*, v. 56, July 8, 2010; Mattioli, Dana, "With Fewer U.S. Opportunities, Home Looks Appealing to Expats," *The Wall Street Journal*, December 17, 2009, p. A27; and Birchard, Karen, "Canada Seeks More Foreign Students," *The Chronicle of Higher Education*, v. 51, April 29, 2005, p. A39.

²² Institute of International Education, *Open Doors 2009: International Students in the United States*, November 16, 2009, <http://opendoors.iienetwork.org/?p=150649>.

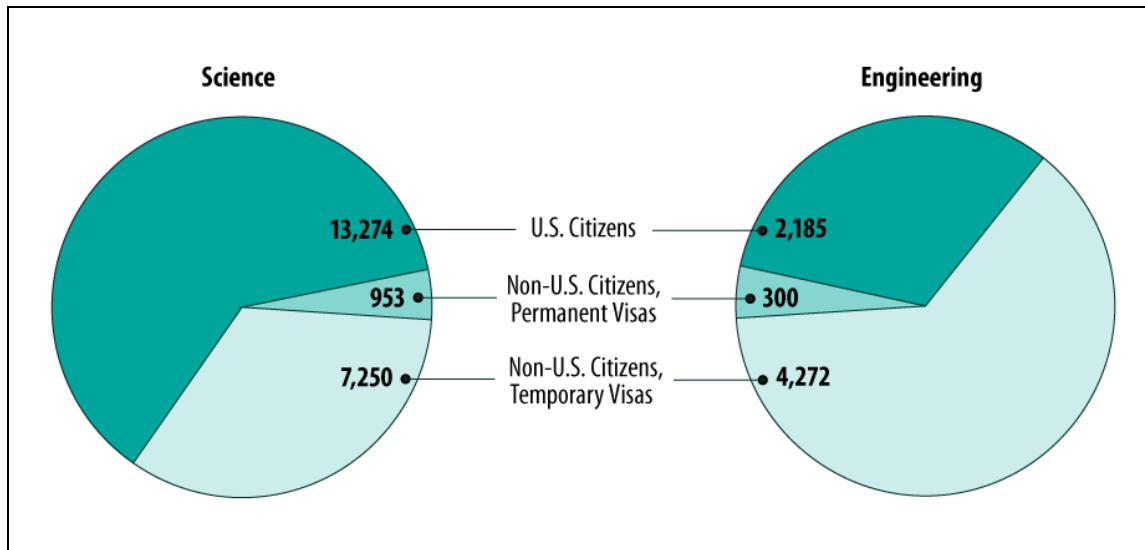
²³ The flow of students from China increased 21.1% from the previous academic school year.

²⁴ A survey separate from the *Open Doors Report* (conducted by higher education associations) states that "The major reasons for the reported increases appear to be largely related to continued active recruitment efforts (cited by 28% of responding institutions), the growing reputation and visibility of U.S. campuses abroad (26%), and an increased number of linkages with institutions in other countries. The responding institutions that experienced declines in international student enrollments cited the world financial crises (cited by 23%), the cost of tuition/fees at U.S. institutions (21%), and home country economic problems (19%) as major reasons for declines at their institutions. Many other respondents indicated students' concerns about the H1N1 virus, lack of financial aid or scholarships, and a poor U.S. job market." Institute of International Education, *Fall 2009: Joint Survey on International Student Enrollments in the US*, November 16, 2009, <http://opendoors.iienetwork.org/?p=150650>. Also see for example Redden, Elizabeth, "Privatized Pathways for Foreign Students," *The Chronicle of Higher Education*, August 4, 2010, v. 56, Government Accountability Office, *Higher Education - United States' and Other Countries' Strategies for Attracting and Funding International Students*, GAO08-878T, Washington, DC, June 19, 2008, 12 pp., and Hermes, JJ, "New Fulbright Grant Brings Scientists to U.S.," *The Chronicle of Higher Education*, v. 54, October 26, 2007, p. A42.

²⁵ *Open Doors 2009: International Students in the United States*. Other or undeclared majors are not included in the rankings of top fields of study.

engineering.²⁶ In 2006, foreign students on temporary resident visas²⁷ earned 32.0% of the doctorates in the sciences, and 58.6% of the doctorates in engineering.²⁸ (See **Figure 1**.) The participation rates in 2005 were 30.8% and 58.4%, respectively. In 2006, permanent resident status²⁹ students earned 4.2% of the doctorates in both the sciences and engineering, a slight change from the 2005 levels of 3.8% in the sciences and 4.4% in engineering. Trend data for science and engineering degrees for the years 1996-2005 reveal that of the non-U.S. citizen population, temporary resident status students consistently have earned the majority of the doctorate degrees. (See **Table 1** and **Table 2**.)

Figure 1. Doctorate Degrees: U.S. and Non-U.S. Citizens, 2006



Source: Science and Engineering Doctorate Awards: 2006, **Table 3**.

Note: An additional 1,186 degrees in the sciences, and 434 degrees in engineering were awarded to individuals of unknown citizenship.

Disaggregated data for the subfields of science provide a detailed picture of degree recipients by U.S. citizenship and non-U.S. citizenship status. In 2006, foreign students (temporary and permanent resident status) were awarded 47.9% of the doctorates in the physical sciences, an increase from the 46.2% awarded in 2005. In mathematics, 55.3% of the doctorates were awarded to foreign students in 2006, a slight increase from the 55.1% awarded in 2005. For the computer sciences, 61.3% were awarded to foreign students, an increase above the 2005 level of 58.8%. The earth, atmospheric, and ocean sciences and the agricultural and biological sciences awarded 35.4% and 33.6% of the degrees respectively to foreign-born students in 2006, compared to the

²⁶ National Science Foundation, *Science and Engineering Doctorate Awards: 2006*, Detailed Statistical Tables, NSF09-311, Arlington, VA, March 2009, Table 3.

²⁷ A temporary resident is a person who is not a citizen or national of the United States and who is in this country on a temporary basis and cannot remain indefinitely. The terms nonresident alien or nonimmigrant are used interchangeably.

²⁸ *Science and Engineering Doctorate Awards: 2006*, Table 3.

²⁹ A permanent resident (“green card holder”) is a person who is not a citizen of the United States but who has been lawfully accorded the privilege of residing permanently in the United States, with certain rights and responsibilities. The terms resident alien or immigrant apply.

2005 levels of 35.7% and 32.1%. In the social sciences and psychology, 24.6% of the doctorates were awarded to foreign students in 2006, almost level with the 24.5% awarded in 2005.³⁰

Table 1. Science Doctorates: Non-U.S. Citizens—Temporary and Permanent Residents as a Percentage of Total Awards, 1997-2006

| | Total Sciences | Temporary Residents | As % of Total Awards | Permanent Residents | As % of Total Awards |
|------|-----------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|
| 1997 | 21,115 | 4,952 | 23.5 | 1,688 | 8.0 |
| 1998 | 21,352 | 5,165 | 24.2 | 1,513 | 7.1 |
| 1999 | 20,601 | 5,049 | 24.5 | 1,250 | 6.1 |
| 2000 | 20,643 | 5,210 | 25.2 | 1,059 | 5.1 |
| 2001 | 20,017 | 5,157 | 25.8 | 972 | 4.9 |
| 2002 | 19,529 | 5,045 | 25.8 | 900 | 4.6 |
| 2003 | 20,001 | 5,472 | 27.4 | 833 | 4.2 |
| 2004 | 20,498 | 5,844 | 28.5 | 761 | 3.7 |
| 2005 | 21,564 | 6,652 | 30.8 | 829 | 3.8 |
| 2006 | 22,663 | 7,250 | 32.0 | 953 | 4.2 |

Source: *Science and Engineering Doctorate Awards: 2006*, Table 3.

Table 2. Engineering Doctorates: Non-U.S. Citizens—Temporary and Permanent Residents as a Percentage of Total Awards, 1997-2006

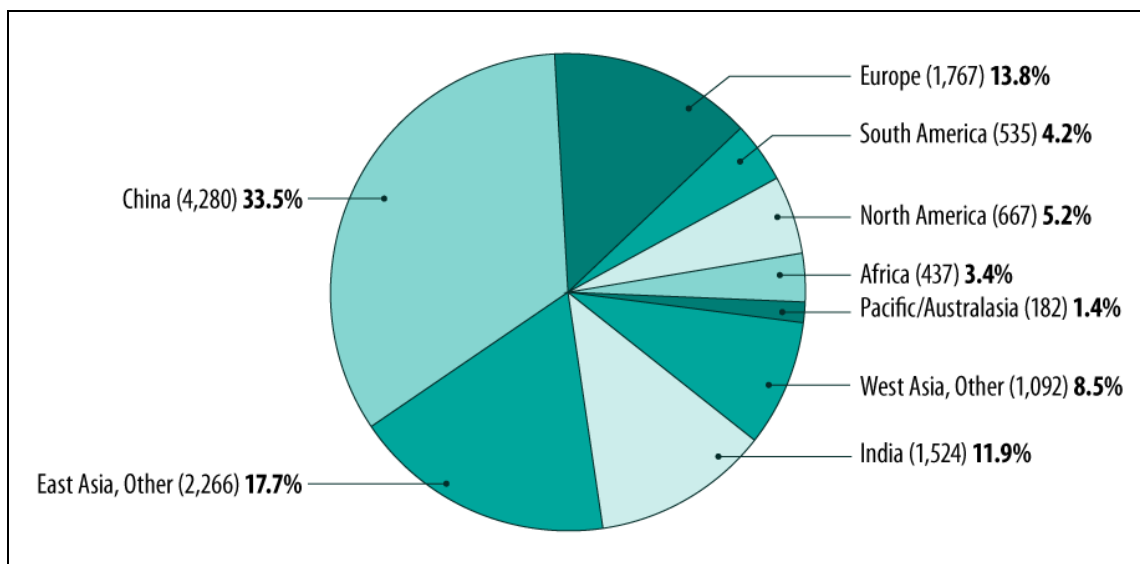
| | Total Engineering | Temporary Residents | As % of Total Awards | Permanent Residents | As % of Total Awards |
|------|--------------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|
| 1997 | 6,114 | 2,555 | 41.2 | 593 | 9.7 |
| 1998 | 5,921 | 2,580 | 43.6 | 478 | 8.1 |
| 1999 | 5,330 | 2,191 | 41.1 | 404 | 7.6 |
| 2000 | 5,323 | 2,451 | 46.0 | 350 | 6.6 |
| 2001 | 5,511 | 2,789 | 50.6 | 299 | 5.4 |
| 2002 | 5,079 | 2,649 | 52.2 | 273 | 5.4 |
| 2003 | 5,280 | 2,912 | 55.2 | 266 | 5.0 |
| 2004 | 5,777 | 3,311 | 57.3 | 242 | 4.2 |
| 2005 | 6,425 | 3,754 | 58.4 | 284 | 4.4 |
| 2006 | 7,191 | 4,272 | 59.4 | 300 | 4.2 |

Source: *Science and Engineering Doctorate Awards: 2006*, Table 3.

³⁰ *Science and Engineering Doctorate Awards: 2006*, Table 3.

The NSF provides specific data on the country of origin of foreign-born science and engineering doctorate awards. Data for 2006 reveal that of the earned doctorate degree holders (non-U.S. citizens), 33.5% were from China, 11.9% were from India, 3.4% were from Taiwan, 2.8% from Canada, 3.4% from Africa, 2.8% from Turkey, 1.7% from Japan, and 1.4% from Germany.³¹ See **Figure 2** for additional disaggregated data on doctorate degrees awarded to non-U.S. citizens by country of origin.

Figure 2. Non-U.S. Citizens Awarded Doctorates in Science and Engineering by Country or Citizenship, 2006



Source: *Science and Engineering Doctorate Awards: 2006*, Table 11.

Note: A total of 25 degrees were awarded to non-U.S. citizens from countries unknown.

Support of Foreign Students in Graduate School

Certain restrictions have been placed on foreign students with temporary resident student status who are enrolled in graduate programs in U.S. institutions. Foreign graduate students are required to be full-time students, and are prohibited, due to visa restrictions, from seeking employment.³² While they are prohibited also from obtaining most fellowships, traineeships or federally guaranteed loans, they are able to be employed as research assistants or teaching assistants on federally funded research projects.

Foreign and U.S. science and engineering graduate students receive financial support from many resources—personal, university (primarily through teaching assistantships, research assistantships/traineeships, fellowships/dissertation grants)³³, foreign government, employer, and

³¹ *Science and Engineering Doctorate Awards: 2006*, Table 11.

³² Restrictions are primarily because of their temporary status and related visa restrictions imposed by the Immigration and Nationality Act.

³³ Private foundations, federal agencies, and state governments are usually the original sources of these funds.

other.³⁴ Many foreign students receive support from their home country, though it is generally limited to the first year of study.³⁵ For the continuing years, the university usually provides support mostly in the form of research assistantships or teaching assistantships. While temporary resident foreign students are ineligible for direct federal aid, the university support provided to them through research assistantships and teaching assistantships often results from federally funded research grants awarded to their home institution.

The 2007 report, *Doctorate Recipients from United States Universities: Summary Report 2006*, reveals that institutions of higher education provide a significant amount of support, primarily through teaching assistantships, research assistantships/traineeships, and fellowships/dissertation grants, to foreign students on temporary and permanent resident visas.³⁶ In all fields, a greater percentage of non-U.S. citizen doctoral recipients receive financial assistance from universities than do U.S. doctoral recipients.³⁷ (See **Table 3** for primary sources of financial support.) A disaggregation of the data by race/ethnicity reveal that 40.6% of Native Americans/Alaska Natives doctoral students relieved on their own resources to finance their graduate studies, followed by blacks at 38.8%, whites, at 30.1%, Hispanics, at 30.7%, and Asians, at 16.9%.³⁸

Table 3. Primary Sources of Financial Support for Doctorate Recipients, 2006

| Primary Source of Support | | Total | U.S. Citizen | Permanent Visa | Temporary Visa |
|--|---|--------|--------------|----------------|----------------|
| All Fields | N | 40,272 | 25,301 | 1,688 | 13,164 |
| -Teaching Assistantships | % | 17.4 | 15.5 | 21.3 | 20.6 |
| - Research Assistantships/Traineeships | % | 28.6 | 17.3 | 31.8 | 50.0 |
| - Fellowships/Dissertation Grants | % | 27.5 | 31.6 | 27.0 | 19.6 |
| - Own Resources | % | 21.3 | 30.0 | 15.9 | 5.3 |
| - Foreign Government | % | 1.4 | D | D | D |
| - Employer | % | 3.7 | D | 2.7 | 0.5 |
| - Other | % | 0.1 | D | D | D |

D= Suppressed to avoid disclosure of confidential information.

Source: *Doctorate Recipients from United States Universities: Summary Report 2006*, pp. 81-82.

Note: Includes only doctorate recipients who reported primary source of support.

³⁴ A significant number of doctoral students receive support from more than one source or one mechanism. Multiple sources of support may occur in the same academic year.

³⁵ An educational bilateral exchange program entered into by then President Bush and Saudi King Abdullah provided full tuition support for approximately 15,000 Saudi students studying in U.S. institutions in the academic school year 2006-2007. "US Schools Compete for Thousands of Saudi Students," *International Herald Tribune*, September 9, 2006.

³⁶Hoffer, Thomas .B., Mary Hess, Vincent Welch, Jr., and Kimberly Williams, *Doctorate Recipients from United States Universities: Summary Report 2006*, National Opinion Research Center, Chicago, 2007, pp. 33-38.

³⁷ Primary mechanisms of support differ broadly by discipline, field of study, race/ethnicity, and citizenship status. Admittedly, various graduate programs have different financial aid policies and mechanisms, with science and engineering programs offering more fellowships and traineeships than other disciplines. In addition, foreign students on temporary and permanent resident status report a lower reliance on personal resources. Research assistantships are the dominant mechanism of financial support used by science and engineering graduate students.

³⁸ *Doctorate Recipients from United States Universities: Summary Report 2006*, p. 81.

In the physical sciences, which include mathematics, computer and information sciences, universities provided the primary support for 84.6% of temporary resident students, 73.1% for permanent residents, and 58.8% for U.S. citizens.³⁹ In engineering, 84.8% of temporary resident students received primary financial support from universities, as did 63.9% of permanent resident students, and 42.8% of U.S. citizen doctoral students. Even in those disciplines where foreign students do not participate with any degree of frequency (i.e., education and the social sciences), larger percentages of foreign doctoral students on temporary and permanent resident visas obtained their primary financial assistance from universities than did comparable U.S. students. In the field of education, 43.6% of temporary resident doctoral students received their primary financial support from universities; for permanent resident students, 41.5%, and for U.S. citizens, 13.4%. In the social sciences, universities provided financial support to 54.0% of temporary resident doctoral students, 43.9% for permanent residents, and 35.7% for U.S. citizens.⁴⁰

Perceived Benefits and Problems

There are divergent views in the scientific and academic community about the effects of a measurable foreign student presence in graduate science and engineering programs. Some argue that U.S. universities benefit from a large foreign citizen enrollment by helping to meet the needs of the university and, for those students who remain in the United States, the nation's economy.⁴¹

Foreign students generate three distinct types of measurable costs and benefits. First, 13 percent of foreign students remain in the United States, permanently increasing the number of skilled workers in the labor force. Second, foreign students, while enrolled in schools, are an important part of the workforce at those institutions, particularly at large research universities. They help teach large undergraduate classes, provide research assistance to the faculty, and make up an important fraction of the bench workers in scientific labs. Finally, many foreign students pay tuition, and those revenues may be an important source of income for educational institutions.⁴²

The noticeable participation of foreign students in graduate programs has generated critical responses by many in the minority community.⁴³ Blacks, Hispanics, and Native Americans, historically underrepresented in the science and engineering fields, contend that disparity exists in

³⁹ University support includes teaching assistantships, research assistantships, and research traineeships.

⁴⁰ *Doctorate Recipients from United States Universities: Summary Report 2006*, p. 81-82.

⁴¹ The *Open Doors 2009* report of the Institute of International Education states that foreign students contribute approximately \$17.8 billion annually to the U.S. economy in money from tuition, living expenses and related costs. An estimated 65.0% of foreign students' primary funding is from sources outside of the United States. Data compiled by the Department of Commerce reveal that U.S. higher education is among the top service sector exports. See also Wildavsky, Ben, "Science Education Across Borders-Why Academic Globalization Should be Welcomed, Not Feared," The New York Academy of Sciences, January 15, 2010, <http://www.nyas.org/Print.aspx>.

⁴² See for example Wildavsky, Ben, "Why Foreign Students Don't Crowd Out Americans," *The Chronicle of Higher Education*, v. 57, September 13, 2010; North, David, "Who Pays? Foreign Students Do Not Help with the Balance of Payments," Center for Immigration Studies, June 2008, 11 pp.; and Borjas, George J., "Do Foreign Students Crowd Out Native Students From Graduate Programs?" National Bureau of Economic Research, Working Paper 10349, March 2004, 24 pp.

⁴³ House Committee on the Judiciary, Subcommittee on Immigration, Citizenship, Refugees, Border Security, and International Law, *U.S. Economy, U.S. Workers and Immigration Reform*, 110th Cong., 1st Sess., May 9, 2007, Written testimony of Flair, T. Willard, President and CEO, Urban League of Greater Miami, "Mass Immigration vs. Black America."

the university science community with respect to foreign students.⁴⁴ It is charged that there is not equal access for U.S. minorities to graduate education, receipt of scholarships, promotion to higher ranks, receipt of research funds, access to outstanding research collaborators, and coauthorship of papers and other outlets for scientific publications. Frank L. Morris, former professor, University of Texas, charged that colleges and universities employ exclusionary mechanisms. Rather than supporting minority graduate students, institutions provided the majority of their resources to departments that have admitted foreign students. In testimony before the Subcommittee on Immigration and Claims, Morris stated that:

The generous immigration policy coupled with the much better and disproportionate and much better subsidy out of U.S. taxpayer funds of foreign doctoral student over all American minority students and especially much better than the support given to African American doctoral students.... This has created a situation that place the economic well being of the African American community in jeopardy because we have received inadequate doctoral training to prepare for or compete in an increasing information and higher order scientifically technologically driven current and future U.S. economy.⁴⁵

Another criticism noted by some is that foreign student teaching assistants do not communicate well with American students. Language as a barrier has been a perennial problem for some foreign students.⁴⁶ There are charges that the “accented English” of the foreign teaching assistants affects the learning process.⁴⁷ A large number of graduate schools require foreign teaching assistants to demonstrate their proficiency in English, but problems remain.⁴⁸ Several states have passed legislation setting English-language standards for foreign students serving as teaching assistants.⁴⁹

Some academics and scientists do not view scientific migration as a problem, but as a net gain. These proponents believe that the international flow of knowledge and personnel has enabled the U.S. economy to remain at the cutting-edge of science and technology. A 2005 report of the National Academies states that:

The participation of international graduate students and postdoctoral scholars is an important part of the research enterprise of the United States. In some fields they make up more than half the populations of graduate students and postdoctoral scholars. If their presence were substantially diminished, important research and teaching activities in academe, industry,

⁴⁴ See for example Walker, Lee H., “Immigration and Its Social and Economic Impact with Respect to Class and Poverty,” *News & Views*, December 1, 2006, <http://www.newcoalition.org/Article.cfm?artId=20352>, Rogers, Ibram, “Black Scholars Speak Out Against Immigration Reform,” *Diverse*, v. 23, June 15, 2006, p. 9, and House Subcommittee on Immigration and Claims, *Impact of Immigration on Recent Immigrants and Black and Hispanic Citizens*, 106th Cong., 1st Sess., March 11, 1999, p. 22. Prepared statement of Julian R. Betts, Associate Professor, Department of Economics, University of California, San Diego.

⁴⁵ *Ibid.*, Testimony of Frank L. Morris, Sr., p. 33.

⁴⁶ In addition to the Korean, Japanese, Vietnamese, Chinese, Arabic and Spanish speaking students, there are the other languages such as Malay, Thai, Indonesian, Tongan, Ibo, Tagalog, Hungarian, Haitian, Creole, and Farsi.

⁴⁷ Gravois, John, “Teach Impediment - When the Student Can’t Understand the Instructor, Who is to Blame?,” *The Chronicle of Higher Education*, v. 51, April 8, 2005, p. A10, and Bollag, Burton, “New Test of English as a Foreign Language Puts an Emphasis on Speaking,” *The Chronicle of Higher Education*, v. 52, October 7, 2005, p. A49.

⁴⁸ Sarkisian, Ellen, *Teaching American Students, A Guide for International Faculty and Teaching Assistants in Colleges and Universities*, Cambridge, Massachusetts, 1997, 109 pp.

⁴⁹ Gravois, John, “Teach Impediment - When the Student Can’t Understand the Instructor, Who is to Blame?,” p. A10.

and federal laboratories would be curtailed, particularly if universities did not give more attention to recruiting and retaining domestic students.⁵⁰

Foreign Scientists and Engineers in the U.S. Labor Force

During the 1980s, the number of immigrant scientists and engineering entering the United States remained somewhat stable (12,000), registering only slight annual increases. In 1992, there was a marked increase in the admissions of scientists and engineering, fueled primarily by the changes in the Immigration Act of 1990 that allowed significant increases in employment-based quotas of H-1B visas. By 1993, the number of scientists and engineers on permanent visas increased to 23,534.⁵¹ The numbers were increased further as a result of the Chinese Students Protection Act of 1992.⁵² The proportion of foreign born scientists and engineers in the U.S. labor force reached a record in 2000, revealing high levels of entry by holders of permanent and temporary visas during the 1990s. The issuance of permanent visas in the past few years has been impacted by administrative changes at the U.S. Citizenship and Immigration Services (USCIS), changes in immigration legislation, and any impact of September 11th.

Foreign scientists and engineers on temporary work visas have generated considerable discussion.⁵³ As previously stated, recent legislation has increased the annual quota for the H-1B program in which foreign-born workers can obtain visas to work in an occupation for up to six years. The H-1B program, generally, is thought of as an entry for technology workers, but it is used also to hire other skilled workers.⁵⁴ A report of the NSF notes that “An H-1B visa is sometimes used to fill a position not considered temporary, for a company may view an H-1B visa as the only way to employ workers waiting long periods for a permanent visa.”⁵⁵ Data on selected occupations for which companies have been given permission to hire H-1B visa workers are contained in **Table 4**.

⁵⁰ *Policy Implications of International Graduate Students and Postdoctoral Scholars in the United States*, p. 65.

⁵¹ National Science Foundation, *Major Declines in Admissions of Immigrant Scientists and Engineers in Fiscal Year 1994*, NSF97-311, Arlington, VA, June 18, 1997, p. 1.

⁵² As an outgrowth of the 1989 Tiananmen Square uprising, Chinese students residing temporarily in the United States were allowed to adjust to permanent resident status in 1993.

⁵³ Ghosh, Palash, “Amidst High Unemployment in U.S., Guest Worker Programs Under Fire,” October 20, 2010, <http://www.ibtimes.com/art/services/print.php?articleid=73926>, and Peri, Giovanni, University of California, Davis, “The Impact of Immigrants in Recession and Economic Expansion,” Migration Policy Institute, June 2010, 24 pp.

⁵⁴ Data from the Office of Immigration Statistics reveal that the industry employing the largest number of H-1B workers in FY2008 was computer systems design and related services. The proportion for H-1B petitions was about the same for computer-related occupations from the previous year: FY2007 (49.7%) and FY2008 (49.6%). Department of Homeland Security, Office of Immigration Statistics, “Characteristics of Speciality Occupation Workers (H-1B): Fiscal Year 2008, Annual Report,” May 1, 2009, p. 11.

⁵⁵ National Science Foundation, *Science and Engineering Indicators 2002*, Volume I, NSB02-1, Arlington, VA, January 15, 2002, pp. 3-32.

Table 4. H-1B Petitions Approved by Major Occupation Group, Fiscal Year 2008

| Occupation | Total | Percent |
|---|---------|---------|
| Computer-Related Occupations | 137,010 | 49.6 |
| Engineering,, Architecture, and Surveying | 30,062 | 10.9 |
| Medicine and Health | 17,778 | 6.4 |
| Miscellaneous Professional, Technical, and Managerial | 5,114 | 1.9 |
| Life Sciences and Social Sciences | 11,904 | 4.3 |
| Mathematics and Physical Sciences | 5,933 | 2.1 |
| Education | 28,880 | 10.5 |
| Other | 39,571 | 14.3 |
| Total | 276,252 | 100.0 |

Source: U.S. Department of Homeland Security, *U.S. Citizenship and Immigration Services, Characteristics of Specialty Occupation Workers (H-1B): Fiscal Year 2008*, May 1, 2009, p. 11. 76 NOTE: "During Fiscal Year 2008, USCIS approved 276,252 H-1B petitions submitted by employers on behalf of alien workers. The number of approved petitions exceeds the number of individual H-1B workers because more than one U.S. employer may file a petition on behalf of individual H-1B workers (multiple petitions). The number of approved petitions for initial employment also exceeds the cap because of beneficiary-based cap exemptions, such as for petitions filed on behalf of aliens with a U.S. advanced degree or employer-based cap exemptions, such as for petitions submitted by nonprofit research organizations or governmental research organizations." p. 4.

Some argue that the influx of immigrant scientists and engineers has resulted in depressed job opportunities, lowered wages, and declining working conditions for U.S. scientific personnel. While many businesses, especially high-tech companies, have recently downsized, the federal government issued thousands of H-1B visas to foreign workers. There are those in the scientific and technical community who contend that an over-reliance on H-1B visa workers to fill high-tech positions has weakened opportunities for the U.S. workforce.⁵⁶ Many U.S. workers argue that a number of the available positions are being filled by foreign labor hired at lower salaries.⁵⁷ Those critical of the influx of immigrant scientists have advocated placing restrictions on the hiring of foreign skilled employees in addition to enforcing the existing laws designed to protect workers. Those in support of the H-1B program maintain that there is no "clear evidence" that foreign workers displace U.S. workers in comparable positions and that it is necessary to hire foreign workers to fill needed positions, even during periods of slow economic growth.⁵⁸ A

⁵⁶ Matloff, Norman, "H-1Bs: Still Not the Best and the Brightest," Center for Immigration Studies, May 2008, 5 pp.; Herbst, Moira, "Still Wanted: Foreign Talent—and Visas," *Business Week*, December 10, 2009; Borjas, George J., National Bureau of Economic Research, *Immigration in High-Skill Labor Markets: The Impact of Foreign Students on the Earnings of Doctorates*, Working Paper 12085, March 2006, 45 pp.; Matloff, Norman, "Should the U.S. Increase its H-1B Visa Program? Con: Wages Belie Claims of a Labor Shortage," *SFGate.com*, December 7, 2006.

⁵⁷ See for example Gamboa, Suzanne, "Visas for High-Tech Workers Draw Query," *The Washington Post*, May 14, 2007; Jorddan, Miriam, Pui Wing Tam and Lauren Etter, "Business Divided As Debate Opens On Immigration," *The Wall Street Journal*, May 22, 2007, p. A1; and Moscoso, Eunice, "Visa Program Ripe for Abuse, Critics Charge," *The Austin American Statesman*, May 13, 2007.

⁵⁸ See for example Sherk, James, and Guinevere Nell, "More H-1B Visas, More American Jobs, a Better Economy," A Report of the Heritage Center for Data Analysis, CDA08-01, April 30, 2008, 7 pp.; Anderson, Stuart, and Michaela Platzer, "Should the U.S. Increase its H-1B Visa Program? PRO: Skilled Immigrants Innovate," *SFGate.com*, December 7, 2006; and Baker, Chris, "Visa Restrictions Will Harm U.S. Technology, Gates Says; Microsoft Chief Calls For End to Caps on Workers," *The Washington Times*, April 29, 2005, p. C13.

September 2006 report of the Government Accountability Office (GAO), *H-1B Visa Program: More Oversight by Labor Can Improve Compliance with Program Requirements*, states that:

Labor's review of employers' H-1B applications is limited by law to identifying omissions and obvious inaccuracies, but we found it does not consistently identify all obvious inaccuracies. ...Labor's Wage and Hour Division (WHD) enforces H-1B program requirements by investigating complaints made against H-1B employers and recently began random investigations of previous program violators. From fiscal year 2000 through fiscal year 2005, complaints and violations increased but changes in the program, such as temporary increases in visa caps, may have been a factor.... However, USCIS does not have a formal mechanism to report such information to Labor, and current law precludes WHD from using this information to initiate an investigation of an employer. Justice pursues charges filed by U.S. workers alleging they were not hired or were displaced so that an H-1B worker could be hired instead, but it has not found discriminatory conduct in most cases.⁵⁹

The maturing of the computer industry has wrought its own set of problems relative to employment of foreign scientists and engineers.⁶⁰ There are some who contend that the salary of the foreign-born computer professionals working in the United States is lower than that of their U.S. counterparts who are the same age and educational level. Others charge that the hiring of H-1B workers "undermines the status and bargaining position of U.S. workers."⁶¹ The Department of Labor (DOL) has sought to enforce the existing policies on temporary employment of nonimmigrant foreign workers under H-1B visas, and to penalize those employers who are found to be in violation.

Many in the scientific community maintain that in order to compete with countries that are rapidly expanding their scientific and technological capabilities, the United States needs to bring in those whose skills will benefit society and will enable us to compete in the new-technology-based global economy.⁶² Individuals supporting this position do believe that the conditions under which foreign talent enters U.S. colleges and universities and the labor force should be monitored more carefully.⁶³ And there are those who contend that the underlying concern of foreign students

⁵⁹ Government Accountability Office, *H-1B Visa Program: More Oversight by Labor Can Improve Compliance with Program Requirements*, GAO-06-901T, Washington, DC, June 22, 2006, p. 3.

⁶⁰ See for example Hart, David M., The Information Technology and Innovation Foundation, *Global Flows of Talent: Benchmarking the United States*, November 17, 2006, 18 pp., Muson, Howard, *Clearing Paths for Critical Foreign Talent to Work in the United States*, The Conference Board, Trusted Insights for Business Worldwide, No. 318, December 2009, 8 pp., Sears, Don E., "H-1B Visa Enforcement to Increase in 2010," *IT Management*, December 28, 2009, and Department for Professional Employees, AFL-CIO, *Gaming the System: Guest Worker Visa Programs and Professional and Technical Workers in the U.S.*, Washington, DC, 2009, 49 pp.

⁶¹ See for example Abate, Tom, "H-1B Federal Immigration Bill: Reforms to the Work Visa Program are a Small Part of the Overall Debate—Except in Silicon Valley," *The San Francisco Chronicle*, May 27, 2007, and Miano, John, *Low Salaries for Low Skills—Wages and Skill Levels for H-1B Computer Workers, 2005*, Center for Immigration Studies, April 2007, 12 pp.

⁶² See for example Fischer, Karin, "Colleges Extend Conditional Admissions to Pull In More International Students," *The Chronicle of Higher Education*, v. 56, August 8, 2010, and Fitz, Marshall, *Prosperous Immigrants, Prosperous Americans, How to Welcome the World's Best Educated, Boost Economic Growth, and Create Jobs*, Center for American Progress, Washington, DC, December 2009, 25 pp.

⁶³ A June 2006 report of the GAO revealed that from January 2002 through September 2005, approximately 33% of the H-1B visa applications were for workers in computer system analysis and programming occupations. The next highest requesting group was those of college and university education workers, at approximately 7%. The GAO report found certified visa applications with inaccurate information and that the review process itself lacked quality assurance controls. Government Accountability Office, *H-1B Visa Program-Labor Could Improve Its Oversight and Increase Information Sharing with Homeland Security*, 52 pp.

in graduate science and engineering programs is not necessarily that there are too many foreign-born students, but that there are not enough native-born students entering the scientific and technical disciplines.⁶⁴

A May 2010 report of the National Science Board states that:

Attracting and retaining foreign-born talent remains an essential pillar of our Nation's STEM [science, technology, engineering, and mathematics] enterprise. As global demand for STEM talent surges, we cannot reliably expect that the best and brightest from abroad will remain in the United States and continue to be a sufficient source of talent. It is essential that we develop our own domestic human capital as well. Ideally, foreign talent should augment a robust domestic STEM talent pipeline, not compensate for its deficiencies.⁶⁵

Policy Implications

The debate on the presence of foreign students in graduate science and engineering programs and the workforce intensified following the terrorist attacks of September 11, 2001. It has been reported that foreign students in the United States are encountering “a progressively more inhospitable environment.”⁶⁶ A June 2006 report of the Association of International Educators, *Restoring U.S. Competitiveness for International Students and Scholars*, states that “... [F]or the first time, the United States seems to be losing its status as the destination of choice for international students.”⁶⁷

Concerns have been expressed about certain foreign students receiving education and training in sensitive areas.⁶⁸ There has been increased discussion about the access of foreign scientists and

⁶⁴ See for example National Science Foundation, *Investing in America's Future—Strategic Plan FY2006-2011*, NSB06-48, Arlington, VA, September 2006, pp. 2-4.

⁶⁵ National Science Board, *Preparing the Next Generation of STEM Innovators: Identifying and Developing Our Nation's Human Capital*, NSB10-33, Arlington, VA, Arlington, VA, p. 9.

⁶⁶ House Committee on the Judiciary, Subcommittee on Immigration, Border Security, and Claims, *Sources and Methods of Foreign Nationals Engaged in Economic and Military Espionage*, 109th Cong., 1st Sess., September 15, 2005, Written testimony of William A. Wulf, President, National Academy of Engineering, p. 12., and Foroohar, Rana, “America Closes Its Doors,” <http://msnbc.msn.com/id/6038977/site/newsweek>.

⁶⁷ International *Herald Tribune* via *The New York Times*, “U.S. Schools Attract Smaller Share of International Students,” September 12, 2010, http://nytimes.com/2010/09/13/education/13iht-educBrief13.html?_r=1&partner=rss; NAFSA: Association of International Educators, *Restoring U.S. Competitiveness for International Students and Scholars*, June 2006, p. 2. See also Labi, Aisha, “Visa Process Keeps Iraqi Students Out of U.S.,” *The Chronicle of Higher Education*, v. 54, p. A1, March 14, 2008, Cohen, David, “Middle Eastern Students Shut Out of the U.S. Turn to Australia and New Zealand,” *The Chronicle of Higher Education*, v. 53, August 17, 2007, p. A37, Redden, Elizabeth, “The Prospective (Foreign) Student,” *Inside Higher Ed*, May 30, 2007, <http://insidehighered.com>, and McMurtrie, Beth, “International Educators Discuss Foreign Recruitment and Study Abroad,” *The Chronicle of Higher Education*, June 8, 2007, v. 53, p. A33.

⁶⁸ See for example Hudson, Audrey, “Foreign Students Labeled ‘Threats’-TSA Wording Raises Alarm,” *The Washington Times*, June 23, 2008, p. A1, Brainard, Jeffrey, “Pentagon Backs Off on Foreign Researchers,” *The Chronicle of Higher Education*, v. 53, September 1, 2006, p. A48, and Cooper, Helene and Thom Shanker, “Draft Iran Resolution Would Restrict Students,” *The New York Times*, October 26, 2006. NOTE: The Bureau of Consular Affairs, Department of State, issues visas to foreign students and maintains a “technology alert list” that includes 15 sensitive areas of study. This critical fields list of major technologies was produced in an effort to help the United States prevent the illegal transfer of controlled technology, and includes, among other things, chemical and biotechnology engineering, rocket systems, nuclear technology, conventional munitions, robotics, and advanced microelectronic technology.

engineers to research and development (R&D) related to chemical and biological weapons. Also, there is discussion of the added scrutiny of foreign students from countries that sponsor terrorism.⁶⁹ The academic community is concerned that the more stringent requirements of foreign students may have a continued impact on enrollments in colleges and universities.⁷⁰ Others contend that a possible reduction in the immigration of foreign scientists may affect negatively on the competitiveness of U.S. industry and compromise commitments made in long-standing international cooperative agreements.⁷¹

The issue of tracking foreign students attending U.S. institutions has generated particular debate in the academic and scientific community following the September 11th terrorist attacks.⁷² Prior to September 11th, the Illegal Immigration Reform and Immigrant Responsibility Act (P.L. 104-208) authorized the Student and Exchange Visa Program/Coordinated Interagency Partnership Regulating International Students (SEVP/CIPRIS).⁷³ This electronic information reporting system for tracking foreign students and researchers was to replace the existing paper-based format. The legislation required colleges and universities to monitor and compile data on foreign students attending their respective institutions in such areas as date of enrollment/reporting, field of study, credits earned, and source of financial support for the student.⁷⁴ The information was to be provided to the INS by the colleges and universities. However, the system was never fully implemented, primarily because institutions described it as being too costly, an “unnecessary burden on colleges and universities,” and “an unreasonable barrier to foreign students.”⁷⁵

The USA Patriot Act (P.L. 107-56) and the Enhanced Border Security and Visa Entry Reform Act (P.L. 107-173) revised and enhanced the process for collecting and monitoring data on foreign

⁶⁹ The State Department publishes a list annually of state sponsors of terrorism. Currently, the list includes four countries—Cuba, Iran, Sudan, and Syria. (North Korea was removed from the list effective October 11, 2008. In June 2009, the Obama Administration indicated that if there was evidence of North Korea’s support for international terrorism, it would consider reinstating it on the list of state sponsors of terrorism.) See CRS Report RL30613, *North Korea: Back on the Terrorism List?*, by (name redacted).

⁷⁰ See for example Douglass, John Aubrey and Richard Edelstein, “The Global Competition for Talent, Center for Studies in Higher Education,” University of California, Berkeley, Research and Occasional Paper Series: CSHE.8.09, October 2009, 22 pp., and American Council on Education, *Leading Academic, Science Groups Propose Visa Reforms to Boost U.S. Economic Competitiveness and Scientific Leadership*, May 18, 2005, <http://www.acenet.edu>.

⁷¹ See for example Holen, Arlene, “The Budgetary Effects of High-Skilled Immigration Reform”, Technology Policy Institute, Washington, DC, March 2009, 37 pp. and “Current Visa Restrictions Interfere with U.S. Science and Engineering Contributions to Important National Needs,” Statement from Bruce Alberts, President National Academy of Sciences, Wm. A. Wulf, President, National Academy of Engineering, and Harvey Fineberg, President, Institute of Medicine, December 13, 2002, <http://www4.nationalacademies.org>.

⁷² Homeland Security Presidential Directive 2, “Combating Terrorism Through Immigration Policies,” and American Association for the Advancement of Science, Science & Technology in Congress, “Tracking Foreign Students,” November 2001, pp. 1, 4, 6.

⁷³ The Illegal Immigration Reform and Responsibility Act was signed into law on October 1, 1996.

⁷⁴ Colleges and universities were required to collect the information, but were not required to automatically report it to the INS.

⁷⁵ Marlene M., Executive Director and CEO, Association of International Educators, “Thinking Clearly About Foreign Students and Terrorism,” September 20, 2001, Peterson, Jonathan, and Trounson, Rebecca, “Foreign Students Being Checked, INS Asked to Create Computerized System,” *Pittsburgh Post-Gazette*, September 29, 2001, p. A-5, Sheridan, Mary Beth, “Visa Tracking System Limited by Lack of Personnel,” *Washington Post*, February 25, 2002, p. A03, Zernike, Kate and Drew, Christopher, “A Nation Challenged: Student Visas; Efforts to Track Foreign Students are Said to Lag,” *New York Times*, January 28, 2002, p. 1A, and “U.S. Urged to Give More Details on Database for Tracking Foreign Students,” *The Chronicle of Higher Education*, v. 48, February 8, 2002, p. A22.

students and researchers in U.S. institutions.⁷⁶ In response to the legislation, the INS developed the Student and Exchange Visitor Information System (SEVIS). SEVIS, a web-based system, was designed to maintain current information on foreign students and exchange visitors in order to ensure that they arrive in the United States, register at the institution or predetermined exchange program, and properly maintain their visa status during their stay.⁷⁷ Congress directed the then INS to have the tracking system in operation by January 30, 2003. The deadline for implementation of SEVIS was extended to February 15, 2003.⁷⁸ However, SEVIS experienced considerable problems and created excessive delays in processing visa applications.⁷⁹ The more rigorous screening of visa applicants was one factor contributing to the delays.⁸⁰ The existing problems with SEVIS are described as being primarily those relating to technical matters and personnel costs. Currently, there is a proposal to implement a second-generation system, SEVIS II, that would expand the capabilities of the current tracking system and address any reported technical difficulties or security issues.⁸¹

On September 13, 2005, the House Subcommittee on National Security, Emerging Threats, and International Relations held a hearing to examine the procedures put in place to correct the gaps and vulnerabilities in the visa process.⁸² Attention was directed at the mechanisms that are necessary to strengthen the visa process as an antiterrorism tool while simultaneously facilitating legitimate travel by foreign students, scientists, researchers, and others in the United States.⁸³ Witnesses testified that consular workloads had increased significantly, yet the visa-processing offices continued to lack strategic direction, adequate resources, and training. In addition, reliable data were not readily available, across and among departments and agencies, to determine security and visa fraud related issues and overall increased visa wait times.⁸⁴ Witnesses stated that

⁷⁶ The USA Patriot Act was signed into law on October 26, 2001. The Enhanced Border Security and Visa Reform Act was signed into law on May 14, 2002.

⁷⁷ For expanded discussion of SEVIS see CRS Report RL32188, *Monitoring Foreign Students in the United States: The Student and Exchange Visitor Information System (SEVIS)*, by (name redacted).

⁷⁸ The deadline for implementation of SEVIS was extended to February 15, 2003. August 1, 2003 was the date by which all institutions must enter data into SEVIS for those students who were enrolled prior to January 30, 2003. NOTE: In addition to SEVIS, the Department of State requires institutions to submit, electronically, basic biographic information about their foreign students. The information becomes part of the Department of State's new Interim Student and Exchange Authentication System (IDEAS), a temporary Web-based international student information collection system required by the Enhanced Border Security Act of 2001. IDEAS is separate from SEVIS and directs that institutions submit the necessary information to both systems. IDEAS went into effect on September 11, 2002 and will remain operational until SEVIS achieves total implementation.

⁷⁹ Murphy, Caryle and Nurith C. Aizenman, "Foreign Students Navigate Labyrinth of New Laws," *Washington Post*, June 9, 2003, p. B01, Greene, Marcia Slacum, "Computer Problems Slow Tracking of Foreign Students," *Washington Post*, March 26, 2003, p. A06, and Arnone Michael, "Colleges Expect the Worse in Preparing for New System to Track Foreign Students," *The Chronicle of Higher Education*, v. 49, September 6, 2002, p. A33. NOTE: Less than 2% of all visas issued are student visas.

⁸⁰ For a discussion of the screening process and review procedures for visa issuance, see, for example, John Marburger, Director, Office of Science and Technology Policy, Speech before the American Association for the Advancement of Science, Science and Technology Policy Colloquium, April 10, 2003, Washington, DC. p. 5.

⁸¹ U.S. Immigration and Customs Enforcement, "Adjusting Program Fees and Establishing Procedures for Out-of-Cycle Review and Recertification of Schools Certified by the Student and Exchange Visitor Program to Enroll F or M Nonimmigrant Students," *Federal Register*, v.73, April 21, 2008, pp. 21260-21286, and Hermes, JJ, "Student-Visa Fee May Grow to Cover Surveillance Costs," *The Chronicle of Higher Education*, v. 54, May 2, 2008, p. A24.

⁸² House Committee on Government Reform, Subcommittee on National Security, Emerging Threats, and International Relations, *Combating Terrorism: Visas Still Vulnerable*, 109th Cong., 1st Sess., September 13, 2005.

⁸³ All 19 of the terrorists of the September 11th attacks had been issued temporary visas.

⁸⁴ The State Department's database did not have any information linking the September 11th attackers with terrorists (continued...)

because visa policies and requirements are ongoing and can change quickly, clear procedures on visa issuance and monitoring operations worldwide are necessary to guarantee that visas are adjudicated in a consistent manner at each visa-issuing post.

The Government Accountability Office (GAO) has released several reports detailing the efforts and the improvements that have been made in the visa processing. Other reports of the GAO assessed agencies' progress in implementing recommended changes in visa operations.⁸⁵ An April 4, 2006 report—*Border Security, Reassessment of Consular Requirements Could Help Address Visa Delays*, stated that while steps have been taken to improve the visa application system, additional issues required immediate attention.⁸⁶ The recommendations included clarifying visa policies and procedures in order to facilitate their implementation, and ensuring that consular officers have access to the needed tools to improve national security and promote legitimate travel.

Comprehensive immigration reform legislation was debated and under consideration during the beginning of the 110th Congress. Those attempts at reform failed and comprehensive reform legislation was not revisited. Comprehensive federal immigration reform has been reintroduced in the 111th Congress. H.R. 4321, Comprehensive Immigration Reform for America's Security and Prosperity Act, would, among other things, exempt specified categories of U.S.-educated immigrants from employment-based immigration limits. The bill would also amend H-1B visa employer application requirements by lengthening U.S. worker displacement protection and prohibiting employer position announcements that specify positions solely to, or that gives priority to, H-1B immigrants. In addition, bills have been introduced in the 111th Congress that are directed at attracting foreign students in the scientific and technical disciplines while maintaining the interests of American scientists.⁸⁷ H.R. 1736, International Science and Technology Cooperation Act, would, among other things, address the various issues that impact the ability of U.S. scientists and engineers to collaborate with foreign counterparts. S. 887, H-1B and L-1 Visa⁸⁸ Reform Act, would amend H-1B employer requirements by limiting the number of H-1B and L-1 employees that an employer of 50 or more workers in the United States may hire. The bill would also direct the DOL to conduct annual audits of businesses with large numbers of H-1B workers. H.R. 1791, Stopping Trained in America Ph.D.s from Leaving the Economy Act (STAPLE), would direct numerical limitations on immigrants who have been awarded a doctorate degree in the scientific disciplines from a U.S. institution and who have an offer of employment

(...continued)

activities, however, there was information in other agencies' databases.

⁸⁵ See for example Government Accountability Office, *Border Security: Stronger Actions Needed to Assess and Mitigate Risks of the Visa Waiver Program*, GAO-06-1090T, September 7, 2006, 23 pp., *H-1B Visa Program: More Oversight by Labor Can Improve Compliance with Program Requirements*, GAO-06-901T, June 22, 2006, 20 pp., *Border Security: Strengthened Visa Process Would Benefit from Improvements in Staffing and Information Sharing*, GAO-05-859, Washington, DC, September 2005, 55 pp., and *Border Security: Streamlined Visas Mantis Program Has Lowered Burden on Foreign Science Students and Scholars, but Further Refinements Needed*, GAO-05-198, Washington, DC, February 18, 2005, 39 pp.

⁸⁶ Government Accountability Office, *Border Security: Reassessment of Consular Resource Requirements Could Help Address Visa Delays*, GAO-06-542T, Washington, DC, April 4, 2006, 17 pp. (Testimony before the House Committee on Government Reform—Statement of Jess T. Ford, Director, International Affairs and Trade.)

⁸⁷ See for example Ballve, Marcelo, " 'Complementarity' & 'Circularity': New Words Fuel Immigration Debate," *New America Media*, News Analysis December 29, 2009, and Martin, Gary, "Immigration Reform Facing Long Odds," December 28, 2009, <http://www.chron.com/disp/story.mpl/nation/6789672.html>.

⁸⁸ An L-1 visa is a nonimmigrant visa which allows a multinational corporation to transfer certain classes of employees from its foreign operations to the United States for a period up to seven years.

from a U.S. employer in a degree-related field. In addition, the bill would provide H-1B visa numerical limitations on immigrants who have earned a doctorate in a scientific discipline and with respect to a petitioning employer, requires that education as a condition of employment.

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