



Immigration of Foreign Nationals with Science, Technology, Engineering, and Mathematics (STEM) Degrees

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Summary

Although the United States remains the leading host country for international students in science, technology, engineering, or mathematics (STEM) fields, the global competition for talent has intensified. A record number of STEM graduates—both U.S. residents and foreign nationals—are entering the U.S. labor market, and there is a renewed focus on creating additional immigration pathways for foreign professional workers in STEM fields. Current law sets an annual worldwide level of 140,000 employment-based admissions, which includes the spouses and children in addition to the principal (i.e., qualifying) aliens. “STEM visa” is shorthand for an expedited immigration avenue that enables foreign nationals with graduate degrees in STEM fields to adjust to legal permanent resident (LPR) status without waiting in the queue of numerically limited LPR visas. The fundamental policy question is should the United States create additional pathways for STEM graduates to remain in the United States permanently?

The number of full-time graduate students in science, engineering, and health fields who were foreign students (largely on F-1 nonimmigrant visas) grew from 91,150 in 1990 to 148,923 in 2009, with most of the increase occurring after 1999. Despite the rise in foreign student enrollment, the percentage of STEM graduate students with temporary visas in 2009 (32.7%) was comparable to 1990 (31.1%). Graduate enrollments in engineering fields have exhibited the most growth of the STEM fields in recent years.

After completing their studies, foreign students on F-1 visas are permitted to participate in employment known as Optional Practical Training (OPT), which is temporary employment that is directly related to an F-1 student’s major area of study. Generally, a foreign student may work up to 12 months in OPT status. In 2008, the Department of Homeland Security (HHS) expanded the OPT work period to 29 months for F-1 students in STEM fields.

Many F-1 visa holders (especially those who are engaged in OPT) often change their immigration status to become professional specialty workers (H-1B). Most H-1B beneficiaries are typically admitted to work in STEM occupations. In FY2010, the most recent year for which detailed data on H-1B beneficiaries (i.e., workers renewing their visas as well as newly arriving workers) are available, almost 91,000 H-1B workers were employed in computer-related occupations, and they made up 47% of all H-1B beneficiaries that year.

The H-1B visa and the OPT often provide the link for foreign students to become employment-based LPRs. In total, foreign nationals reporting STEM occupations made up 44% of all of the 676,642 LPRs who were employment-based principal immigrants during the decade of FY2000-FY2009. Of all of the LPRs reporting STEM occupations (297,668) over this decade, 52% entered as professional and skilled workers. STEM graduates seeking LPR status are likely to wait in line to obtain LPR status. Those immigrating as professional and skilled workers face wait times of many years, but those who meet the criteria of the extraordinary ability or advanced degrees preference categories have a much shorter wait.

There may be renewed interest in establishing STEM visas in the 112th Congress, and several bills (H.R. 399, H.R. 2161, H.R. 3146, S. 1965, and S. 1986) have been introduced. The House Committee on the Judiciary held two hearings on these issues in 2011. These issues also arose during a 2011 Senate Committee on the Judiciary hearing on the economic rationale for immigration reform. No legislation on STEM visas, however, has moved through committees thus far.

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Congress is renewing its interest in facilitating the immigration of foreign professional workers in science, technology, engineering, or mathematics (STEM) fields. The STEM workforce is seen by many as a catalyst of U.S. global economic competitiveness and is likewise considered a key element of the legislative options aimed at stimulating economic growth.¹ “STEM visa” is a shorthand for an expedited immigration avenue that enables foreign nationals with graduate degrees in STEM fields to adjust their immigration status to legal permanent residence (LPR) without waiting in the queue of numerically-limited LPR visas.² The fundamental policy question is: should the United States create additional pathways for STEM graduates to remain in the United States permanently? Or, are current avenues adequate?

The answer to the question lies at the nexus of education policy, labor force needs, and immigration priorities. More precisely, the key elements are: the source countries of international STEM students; the hiring choices of U.S. employers; and, the statutory limits and priorities of U.S. immigration law. This report opens by presenting a statistical portrait of foreign nationals studying STEM fields in U.S. institutions. An analysis of the current avenues foreign nationals with STEM degrees use to work in the United States temporarily and permanently follows. Discussions of the legislative history, current legislation, and major issues of debate conclude the report.

Background

The Immigration and Nationality Act (INA) currently allocates 140,000 visas annually for economic immigrants, of which over 120,000 are allocated to three employment-based preference categories. These employment-based LPR categories are (1) persons of extraordinary ability in the arts, sciences, education, business, or athletics; outstanding professors and researchers; and certain multinational executives and managers; (2) members of the professions holding advanced degrees or persons of exceptional ability; and (3) skilled workers with at least two years training, professionals with baccalaureate degrees, and unskilled workers in occupations in which U.S. workers are in short supply.³

Although the United States remains the leading host country for international students in STEM fields, the global competition for talent, most notably with the European Union and Asian nations, has intensified in recent years. Concerns that these educational and career opportunities foster a “brain drain” of professionals from developing nations are infrequently expressed in the current debate. Instead, some researchers warn of a “reverse brain drain” because the United States does not allocate what they consider to be a sufficient number of visas for high-skilled immigrants to fuel the economy. According to the U.S. Department of Commerce, “growth in STEM jobs was three times as fast as growth in non-STEM jobs” over the past ten years.⁴

¹ For a fuller discussion of science, technology, engineering, or mathematics (STEM) fields, see CRS Report R42430, *America COMPETES 2010 and the FY2013 Budget*, by Heather B. Gonzalez; and CRS Report R42470, *An Analysis of STEM Education Funding at the NSF: Trends and Policy Discussion*, by Heather B. Gonzalez.

² For a complete discussion of the employment-based visa queue, see CRS Report R42048, *Numerical Limits on Employment-Based Immigration: Analysis of the Per-Country Ceilings*, by Ruth Ellen Wasem.

³ The other two economic preference categories are: special immigrants who largely consist of religious workers and certain former employees of the U.S. government; and investors who invest at least \$1 million (or less money in rural areas or areas of high unemployment) to create at least 10 new jobs. §203(b) of INA; 8 U.S.C. §1153.

⁴ Committee on Science, Engineering, and Public Policy, *Policy Implications of International Graduate Students and* (continued...)

Other researchers maintain that a record number of STEM graduates—both U.S. residents and foreign nationals—are entering the U.S. labor market. They express concern that foreign nationals would displace U.S. residents in the STEM fields if additional visas were allocated. Some analysts observe that the only high-skilled occupations that experienced negative wage growth in recent years were technology-related occupations (e.g., computer programmers and engineers)—occupations in which highly-educated foreign nationals cluster. Almost two-thirds of the 9.3 million people in the U.S. labor market who had STEM degrees in 2010 were employed in non-STEM occupations.⁵

Caveat

There is no generally accepted definition of what specific academic disciplines “STEM” encompasses. The National Science Foundation (NSF) studies the fields broadly and includes biological, agricultural, and environmental life sciences; computer and information sciences; mathematics and statistics; the physical sciences; psychology; the social sciences; engineering; and health fields.⁶ For the purposes of tracking foreign students who study in the United States, the Department of Homeland Security’s Immigration and Customs Enforcement (ICE) defines STEM more narrowly and does not include economics, sociology, and political science; however, ICE recently expanded its list, adding fields such as animal science, educational statistics, environmental science, nutritional science, and various specializations within psychology.⁷ The National Center for Education Statistics often uses the ICE definition.⁸

(...continued)

Postdoctoral Scholars in the United States, National Academies Press, 2005; Vivek Wadhwa, Guillermina Jasso, and Ben Rissing, et al., *Intellectual Property, the Immigration Backlog, and a Reverse Brain-Drain, part III*, Duke University, New York University, Harvard Law School and the Ewing Marion Kauffman Foundation, August 2007; and, David Langdon, George McKittrick, and David Beede, et al., *STEM: Good Jobs Now and for the Future*, U.S. Department of Commerce Economics and Statistics Administration, 03-11, July 2011, http://www.esa.doc.gov/sites/default/files/reports/documents/stemfinaljuly14_1.pdf.

⁵ Thomas Lemieux, “The Changing Nature of Wage Inequality,” *Journal of Population Economics*, vol. 21, no. 1 (January 2008); David Card and John E. DiNardo, “Skill-Biased Technological Change and Rising Wage Inequality: Some Problems and Puzzles,” *Journal of Labor Economic*, vol. 20, no. 4 (2002); B. Lindsay Lowell, Hal Salzman, and Hamutal Bernstein, *Steady as She Goes? Three Generations of Students through the Science and Engineering Pipeline*, Rutgers University and the Institute for the Study of International Migration, October 2009; and, U.S. Congress, House Committee on the Judiciary, Subcommittee on Immigration Policy and Enforcement, *STEM the Tide: Should America Try to Prevent an Exodus of Foreign Graduates of U.S. Universities with Advanced Science Degrees*, testimony of Dr. B. Lindsey Lowell, 112th Cong., 1st sess., October 5, 2011; and David Langdon, George McKittrick, and David Beede, et al., *STEM: Good Jobs Now and for the Future*, U.S. Department of Commerce Economics and Statistics Administration, 03-11, July 2011, http://www.esa.doc.gov/sites/default/files/reports/documents/stemfinaljuly14_1.pdf.

⁶ Peter Einaudi, *Two Decades of Increasing Diversity More than Doubled the Number of Minority Graduate Students in Science and Engineering*, National Science Foundation, NSF 11-319, July 2011, <http://www.nsf.gov/statistics/infbrief/nsf11319/nsf11319.pdf>.

⁷ For a detailed list of the Immigration and Custom Enforcement STEM-designated degree programs, see <http://www.ice.gov/doclib/sevis/pdf/stem-list-2011.pdf>.

⁸ National Center for Education Statistics, *Postsecondary Awards in Science, Technology, Engineering, and Mathematics, by State: 2001 and 2009*, U.S. Department of Education, April 2011, <http://nces.ed.gov/pubs2011/2011226.pdf>.

Temporary Foreign Students

International students pursuing STEM degrees in the United States are part of a long tradition of foreign students studying at U.S. institutions of higher education. Since the Immigration Act of 1924, the United States has expressly permitted foreign students to study in U.S. institutions. While their presence is generally viewed as a positive one, Congress has strengthened the reporting requirements of educational institutions with foreign students.⁹ Foreign students are among the various categories of foreign nationals who are known as nonimmigrants.¹⁰

The most common visa for foreign students is the F-1 visa. It is tailored for international students pursuing a full-time academic education.¹¹ Spouses and children may accompany the F-1 visa holders on F-2 visas, but are not permitted to work. Students on F visas are generally barred from off-campus employment; however, they are permitted to work in practical training that relates to their degree program, such as paid research and teaching assistantships.¹² The Department of Homeland Security (DHS) Student and Exchange Visitor Information System (SEVIS) database reports 512,884 F-1 students were in active status (i.e., enrolled full-time or otherwise engaged in approved activities) in FY2010.¹³

Foreign Nationals Earning STEM Degrees

The number of full-time graduate students in science, engineering, and health fields who were foreign students grew from 91,150 in 1990 to 148,923 in 2009. Based upon the more broadly-defined NSF data, **Figure 1** shows that most of the increase occurred after 1999. Despite the rise in foreign student enrollment, the percentage of STEM graduate students with temporary visas in 2009 (32.7%) was comparable to 1990 (31.1%). Graduate enrollments in engineering fields have exhibited the most growth of STEM fields in recent years.¹⁴

⁹ CRS Report RL32188, *Monitoring Foreign Students in the United States: The Student and Exchange Visitor Information System (SEVIS)*, by Alison Siskin; and CRS Report RL31146, *Foreign Students in the United States: Policies and Legislation*, by Chad C. Haddal.

¹⁰ Nonimmigrants are admitted for a designated period of time and a specific purpose. There are 24 major nonimmigrant visa categories, which are commonly referred to by the letter and numeral that denotes their subsection in the INA; for example, B-2 tourists, E-2 treaty investors, F-1 foreign students, or H-1B temporary professional workers. CRS Report RL31381, *U.S. Immigration Policy on Temporary Admissions*, by Ruth Ellen Wasem.

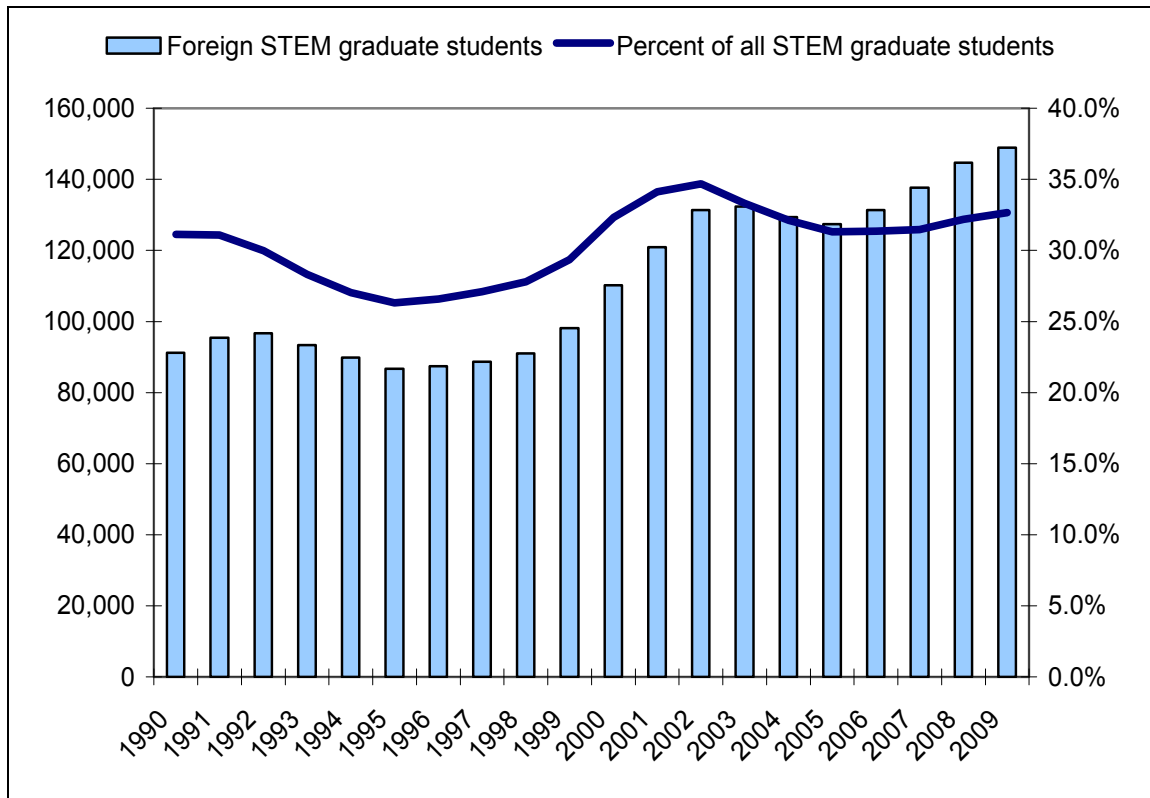
¹¹ Those students who wish to pursue a non-academic (e.g., vocational) course of study apply for an M visa. Their spouses and children may accompany them as M-2 nonimmigrants. Some graduate students use the J visa for cultural exchange, which covers educational, research or scholarship purposes.

¹² 8 C.F.R. 214.2(f)(15)(i).

¹³ SEVIS is the foreign student monitoring database. For background on SEVIS, see CRS Report RL32188, *Monitoring Foreign Students in the United States: The Student and Exchange Visitor Information System (SEVIS)*, by Alison Siskin.

¹⁴ Until the 2000s, the enrollment of U.S. citizens in graduate science and engineering programs had not kept pace with that of foreign students in these programs. NSF researchers cite the growth in the numbers of U.S. citizens and permanent residents pursuing graduate-level study in STEM fields in recent years as the reason the percentage of foreign STEM students has remained level. Peter Einaudi, *Two Decades of Increasing Diversity More than Doubled the Number of Minority Graduate Students in Science and Engineering*, National Science Foundation, NSF 11-319, July 2011, <http://www.nsf.gov/statistics/infbrief/nsf11319/nsf11319.pdf>.

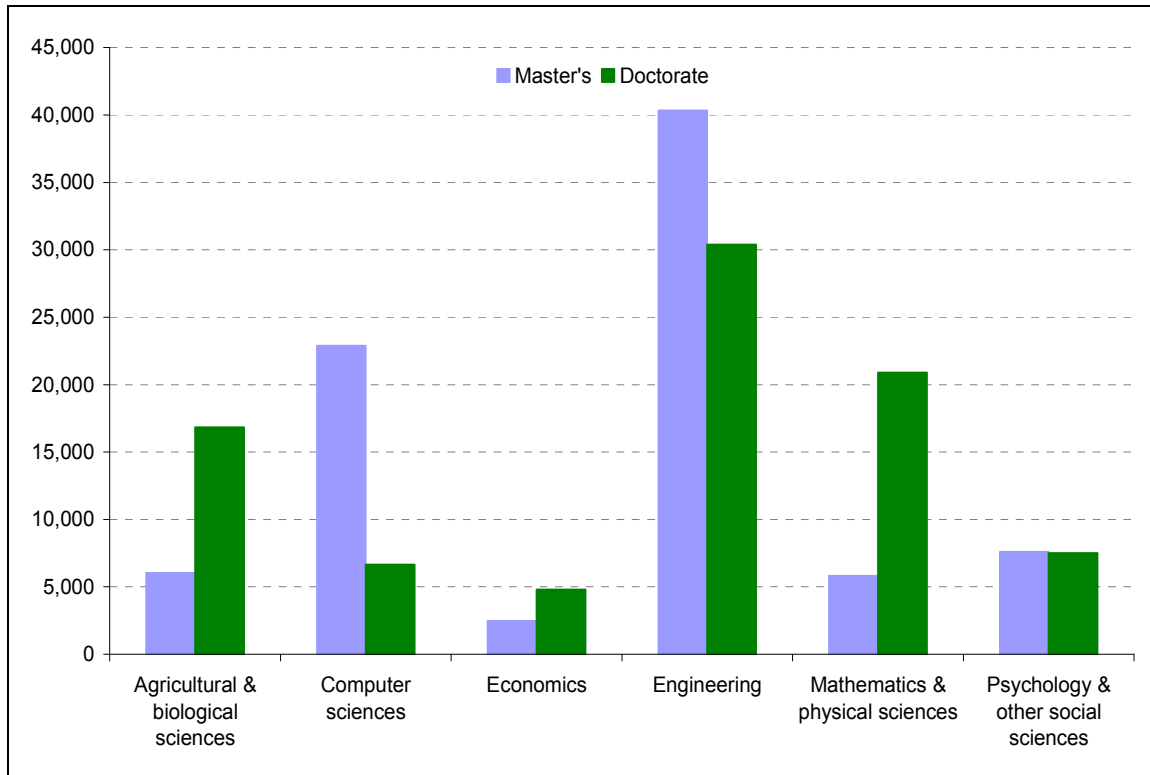
Figure 1. Full-Time Graduate Students with Temporary Visas in Science, Engineering, and Health Fields, 1990-2010



Source: National Science Foundation/National Center for Science and Engineering Statistics, NSF-NIH Survey of Graduate Students and Postdoctorates in Science and Engineering.

A snapshot of degrees granted to foreign students by broad categories indicates that engineering is leading field for both MA and Ph.D. recipients in 2010 (**Figure 2**). Computer science fields follow for MA degrees; while mathematics and physical sciences place second for Ph.D. degrees. Although based upon data from ICE, the STEM fields presented in **Figure 2** use the broader NSF definition of STEM, which includes economics, sociology, psychology and political science as well as agricultural and life sciences, computer sciences, mathematics and the physical sciences.

Figure 2. Foreign Nationals Receiving Advanced Degrees in STEM Fields, 2009
By broad categories



Source: Department of Homeland Security, U.S. Immigration and Customs Enforcement, Student and Exchange Visitor Information System database, special tabulations for the National Science Foundation, 2010.

Note: Although based upon data from ICE, these STEM fields use the broader NSF definition of STEM.

India was the top sending country for STEM graduates earning masters degrees and represented 56% of all STEM graduates earning masters degrees in 2009 (**Table 1**). Indian graduate students studying engineering and computer science led in masters degrees. Students from China placed second at 15% and were more evenly distributed across STEM fields, with the exception of engineering. The remaining top 8 sending countries accounted for a total of 13% of all foreign students earning masters degrees in STEM fields in 2009, less than that of China.

In terms of doctoral degrees (**Table 2**), China sent the most STEM graduates in 2009, making up 35%. Chinese Ph.D. recipients were almost half of all foreign nationals in mathematics and physical sciences and roughly a third of all foreign nationals in the other STEM fields (except psychology and the social sciences). Doctoral degree recipients from India represented 16% of STEM doctorates in 2009.¹⁵

¹⁵ Although based upon data from ICE, the STEM fields presented in **Figure 2**, **Table 1**, and **Table 2** use the broader NSF definition of STEM. Joan Burrelli, *Foreign Science and Engineering Students in the United States*, National Science Foundation, NSF 10-324, July 2010, <http://www.nsf.gov/statistics/infbrief/nsf10324/>.

Table 1. Master's Degrees in STEM Fields Awarded to Foreign Nationals, 2009

Top 10 sending countries by broad categories

	Agricultural Biological Sciences	Computer Science	Economics	Engineering	Mathematics Physical Sciences	Psychology Social Sciences	Percent of Total
Total Master's	6,050	22,880	2,480	40,300	5,810	7,600	
India	2,750	16,270	140	26,290	1,210	500	56%
China	1,030	2,240	1,040	5,100	2,290	1,220	15%
Taiwan	240	520	100	1,240	200	340	3%
South Korea	140	440	140	910	280	670	3%
Nepal	160	460	50	430	110	100	2%
Saudi Arabia	70	320	40	380	90	110	1%
Canada	150	70	30	210	70	470	1%
Japan	90	70	40	130	70	520	1%
Turkey	30	130	80	380	60	190	1%
Thailand	40	250	40	330	40	90	1%

Source: Department of Homeland Security, U.S. Immigration and Customs Enforcement, Student and Exchange Visitor Information System database, special tabulations for the National Science Foundation, 2010.

Note: Although based upon data from ICE, these STEM fields use the broader NSF definition of STEM.

Table 2. Doctorate Degrees in STEM Fields Awarded to Foreign Nationals, 2009

Top 10 sending countries by broad categories

	Agricultural Biological Sciences	Computer Science	Economics	Engineering	Mathematics Physical Sciences	Psychology Social Sciences	Percent of Total
Total Doctorates	16,830	6,650	4,800	30,380	20,900	7,490	
China	5,550	2,410	1,300	10,570	8,680	980	35%
India	3,600	1,250	370	5,690	2,800	530	16%
South Korea	1,080	520	530	3,100	1,240	1,070	9%
Taiwan	930	220	150	1,480	700	400	4%
Turkey	250	210	280	980	440	460	3%
Iran	90	210	60	1,830	270	50	3%
Canada	460	90	80	430	380	690	2%
Japan	240	30	160	160	210	340	1%
Germany	210	70	100	150	250	210	1%
Nepal	200	40	60	160	410	50	1%

Source: Department of Homeland Security, U.S. Immigration and Customs Enforcement, Student and Exchange Visitor Information System database, special tabulations for the National Science Foundation, 2010.

Note: Although based upon data from ICE, these STEM fields use the broader NSF definition of STEM.

Temporary Foreign Workers

The Immigration and Nationality Act of 1952 authorized visas for foreign nationals who would perform needed services because of their high educational attainment, technical training, specialized experience, or exceptional ability. Today, there are several temporary visa categories that enable employment-based temporary admissions for highly skilled foreign workers. They perform work that ranges from professional and skilled labor to those who work in jobs requiring extraordinary ability in the sciences, arts, education, business, or athletics.

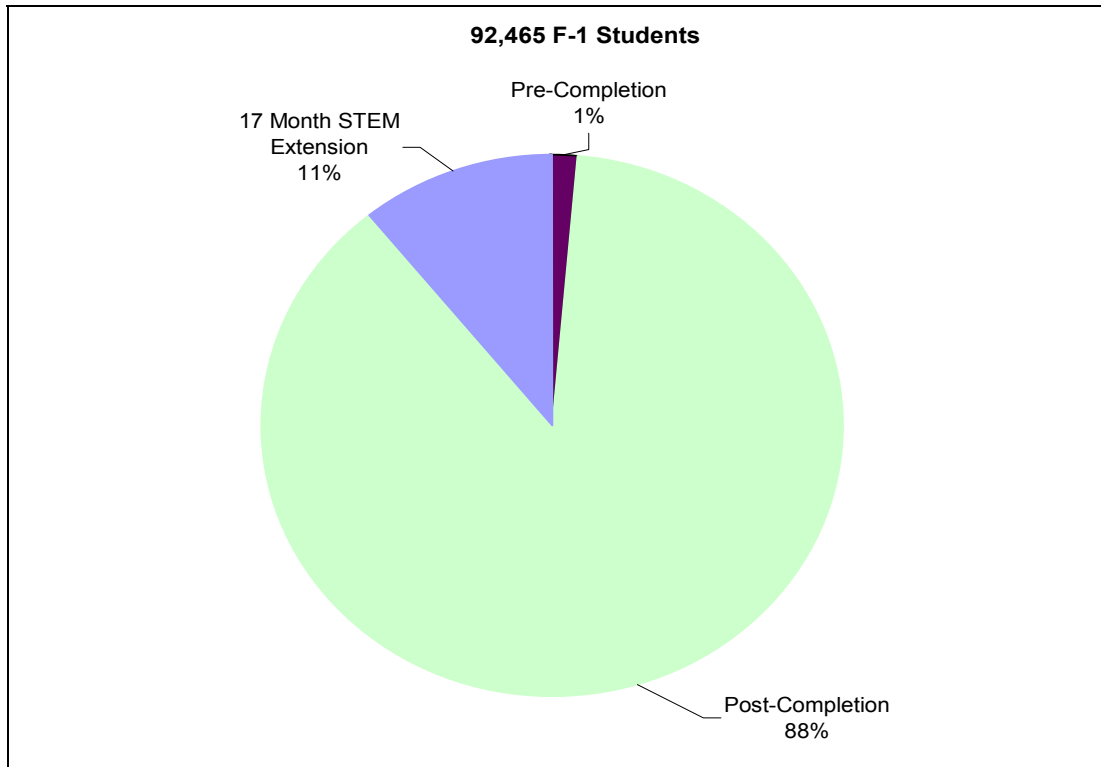
Optional Practical Training (OPT)

After completing their studies, F-1 foreign students are permitted to participate in employment known as Optional Practical Training (OPT), which is temporary employment that is directly related to an F-1 student's major area of study. Generally, an F-1 foreign student may work up to 12 months in OPT status. In 2008, DHS expanded the OPT work period to 29 months for F-1 students in STEM fields. To qualify for the 17-month extension, F-1 students must have received STEM degrees included on the STEM Designated Degree Program List, be employed by employers enrolled in E-Verify,¹⁶ and have received an initial grant of post-completion OPT related to such a degree (i.e., already approved for 12 months in OPT).¹⁷

According to U.S. Citizenship and Immigration Service (USCIS), the number of F-1 visa holders who are engaged in OPT was 92,465 in FY2010. They comprise 18% of all active F-1 foreign students in FY2010. STEM graduates performing OPT during their first year after graduation are included among the 82,206 F-1 students shown in **Figure 3** as "Post-Completion." In addition, there were 10,022 F-1 students who obtained the 17-month extension for OPT in STEM fields.

¹⁶ E-Verify is an electronic employment eligibility verification program that U.S. employers voluntarily use to confirm the new hires' employment authorization through Social Security Administration and, if necessary, DHS databases. CRS Report R40446, *Electronic Employment Eligibility Verification*, by Andorra Bruno.

¹⁷ 8 C.F.R. 214.2(f)(10).

Figure 3. F-1 Foreign Students Performing Optional Practical Training in FY2010

Source: CRS presentation of data from U.S. Citizenship and Immigration Services.

Notes: Post-Completion category includes those STEM graduates in the first year of OPT.

Temporary Professional Specialty Worker: H-1B Visas

Many F-1 visa holders (especially those who are engaged in OPT) often change their immigration status to become professional specialty workers (H-1B). Other H-1B visa holders, however, are adjusting from another immigration status or coming directly from abroad. The law sets numerical restrictions on annual admissions of the H-1B (65,000). Most H-1B workers, however, enter on visas that are exempt from the ceiling because they are returning workers or they work for universities and nonprofit research facilities that are exempt from the cap. The H-1B visas are closely associated with STEM fields, but are not limited to them.

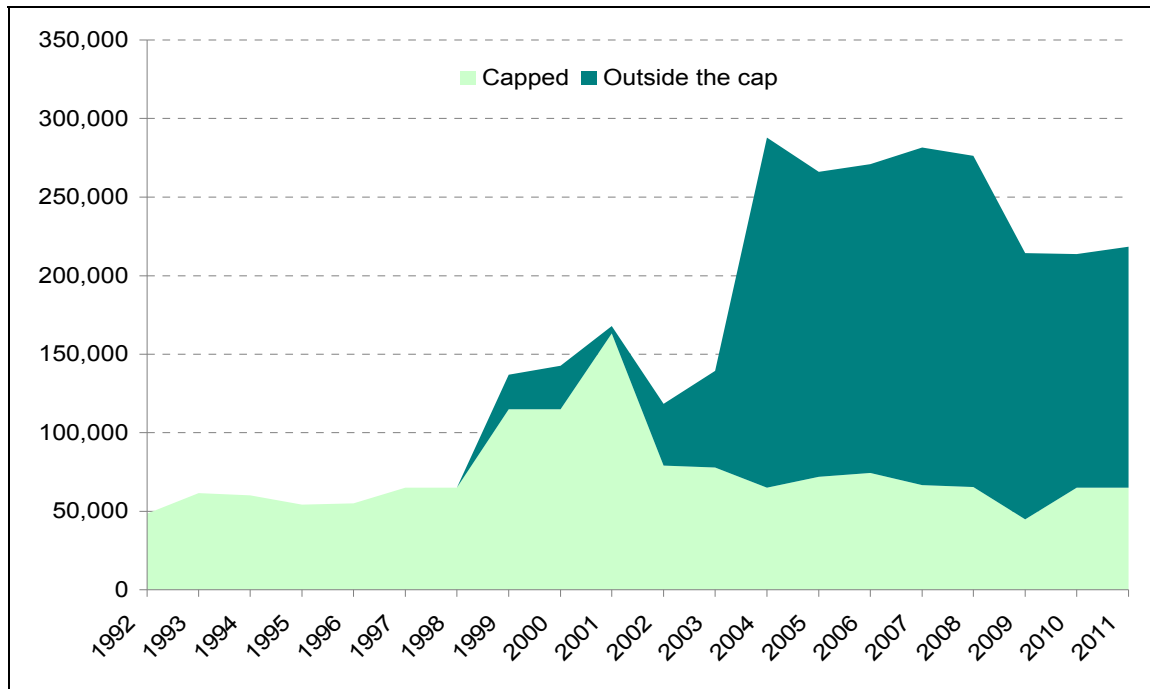
Prospective H-1B nonimmigrants must demonstrate to USCIS that they have the requisite education and work experience for the posted positions. After the Department of Labor (DOL) approves the labor attestation, USCIS processes the petition for the H-1B nonimmigrant (assuming other immigration requirements are satisfied) for periods up to three years. An alien can stay a maximum of six years on an H-1B visa.

The H-1B labor attestation, a three-page application form, is the first step for an employer wishing to bring in an H-1B professional foreign worker. The attestation is a statement of intent rather than a documentation of actions taken.¹⁸ In the labor attestation for an H-1B worker, the

¹⁸ Attestation was part of a compromise package on H-1B visas that included annual numerical limits in the (continued...)

employer must attest that the firm will pay the nonimmigrant the greater of the actual wages paid to other employees in the same job or the prevailing wages for that occupation; the firm will provide working conditions for the nonimmigrant that do not cause the working conditions of the other employees to be adversely affected; and that there is no applicable strike or lockout. The firm must provide a copy of the labor attestation to representatives of the bargaining unit or—if there is no bargaining representative—must post the labor attestation in conspicuous locations at the work site.¹⁹

Figure 4. Total H-1B Petitions Approved, FY1992-FY2011



Source: CRS presentation of data from the DHS Office of Immigration Statistics (OIS) and its predecessor in the Immigration and Naturalization Service.

Notes: Congress increased the H-1B cap to 115,000 for FY1999-FY2000 and to 195,000 for FY2001-FY2003.

In FY2011, there were 218,500 H-1B professional specialty worker petitions approved, down from a high of 288,000 in FY2004. Although the law sets a numerical limit of 65,000 H-1B workers each year, only initial grants are counted under the cap. As noted above, there are several categorical exceptions to the cap, most notably all H-1B nonimmigrants who work for universities and nonprofit research facilities. A provision in P.L. 108-447 also exempts up to 20,000 aliens holding a master's or higher degree from the numerical limit on H-1B visas. As **Figure 4** displays, over the past decade more H-1B workers were approved outside of the numerical cap of 65,000 than under the cap. Not all H-1B workers with approved petitions actually use the visa.

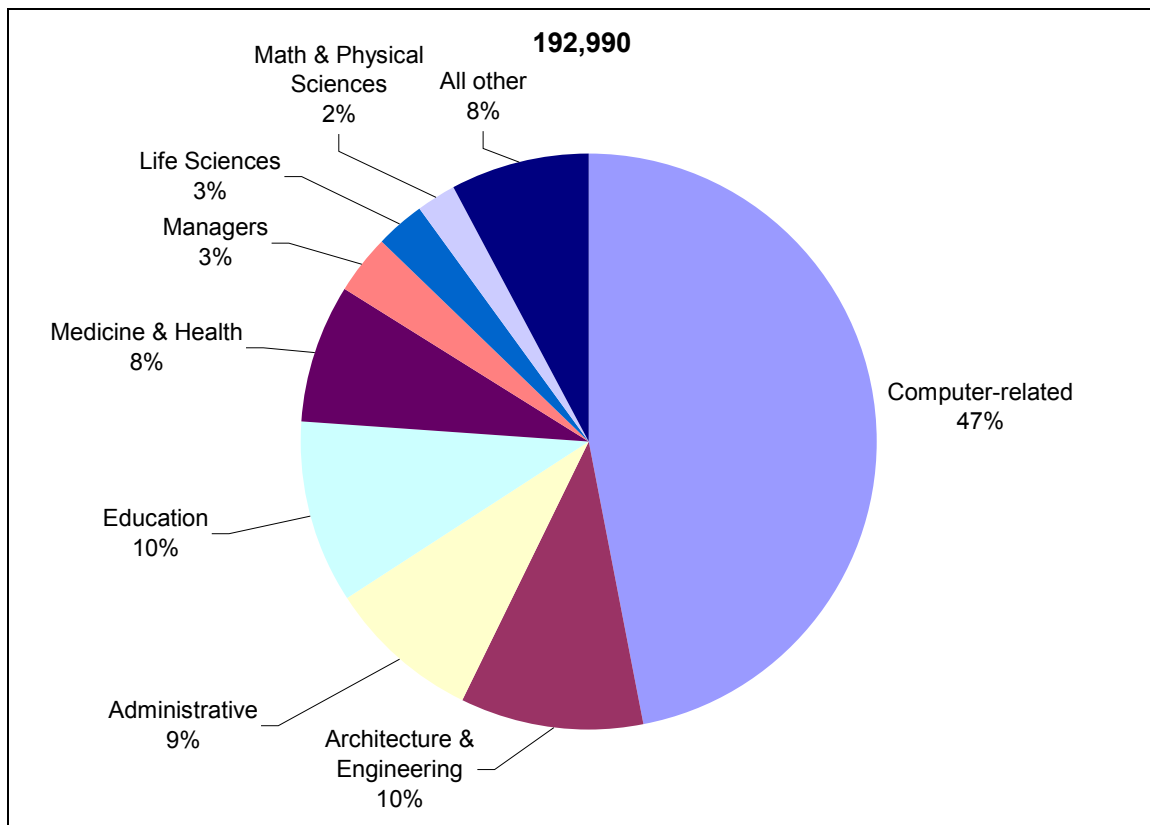
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Immigration Act of 1990 (P.L. 101-649). See CRS Report RL30498, *Immigration: Legislative Issues on Nonimmigrant Professional Specialty (H-1B) Workers*, by Ruth Ellen Wasem.

¹⁹ INA §212(n); 8 C.F.R. §214.2(h)(4). For a further discussion of labor attestations, see CRS Report RL30498, *Immigration: Legislative Issues on Nonimmigrant Professional Specialty (H-1B) Workers*, by Ruth Ellen Wasem.

Over the years, a noteworthy portion of H-1B beneficiaries have worked in STEM occupations. In FY2010, the most recent year for which detailed data on H-1B beneficiaries (i.e., workers renewing their visas as well newly arriving workers) are available, almost 91,000 H-1B workers were employed in computer-related occupations, and they made up 47% of all H-1B beneficiaries that year, as **Figure 5** indicates. Architectural and engineering occupations as well as occupations in education were tied at a distant second with 10% each. Administrative occupations followed with 9%, and health and medicine occupations were 8% of the 192,990 H-1B beneficiaries. The total number of H-1B beneficiaries reported for FY2010 (192,990) and shown in **Figure 5** was less than the number of approved H-1B petitions approved that year as depicted in **Figure 4**.²⁰

Figure 5. Occupations of H-1B Worker Beneficiaries in FY2010



Source: CRS presentation of data from U.S. Citizenship and Immigration Services.

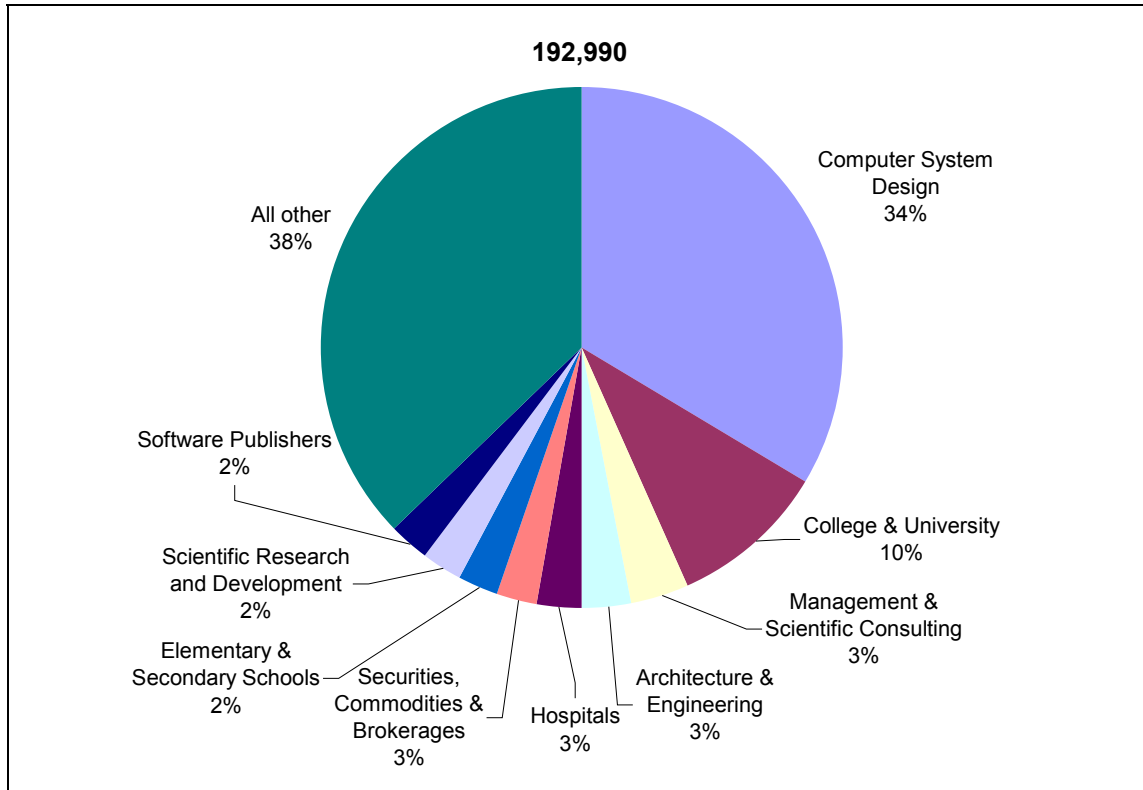
Note: H-1B beneficiaries include workers renewing their visas as well newly arriving workers.

In terms of the broad trade group categories in which the H-1B beneficiaries were employed in FY2010, the leading trade group was computer systems design, which employed about a third (34%) of the H-1B workers (**Figure 6**). Colleges and universities employed 10% of the H-1B beneficiaries. Similar numbers of H-1B beneficiaries were employed in the following trade/industry sectors: management and scientific consulting; architecture and engineering; hospitals; and, securities, commodities, and brokerages. Each of these groups have hired about 3% of the H-1B beneficiaries. **Figure 6** shows that a noteworthy portion of the H-1B

²⁰ U.S. Citizenship and Immigration Services, *Characteristics of H-1B Specialty Occupation Workers, Fiscal Year 2010 Annual Report*, Department of Homeland Security, August 4, 2011.

beneficiaries (38%) were not employed in one of the top trade/industry sectors, suggesting they are employed across the various trade/industry sectors.²¹

Figure 6. Top Trade/Industry Sectors Hiring H-1B Worker Beneficiaries, 2010



Source: CRS presentation of data from U.S. Citizenship and Immigration Services.

Note: H-1B beneficiaries include workers renewing their visas as well newly arriving workers.

Other Professional Specialty Workers: TN and E-3 Visas

There are two nonimmigrant visa categories quite similar to H-1B visas that are designated for temporary professional workers from specific countries. These visas are based upon specific trade agreements foreign nations have signed with the United States. Canada and Mexico temporary professional workers may enter according to terms set by the North American Free Trade Agreement (NAFTA) on TN visas. The E-3 treaty professional visa is a temporary work visa limited to citizens of Australia.²² Occupationally, they mirror the H-1B visa in that the foreign worker on an E-3 visa or a TN visa must be employed in a specialty occupation. They do not, however, require a labor attestation.

There are several other employment-based nonimmigrant visas for which foreign students with STEM degrees may be eligible. These nonimmigrants include cultural exchange workers on J

²¹ Ibid.

²² §501 of P.L. 109-13, the Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Tsunami Relief, 2005.

visas; multinational executive and specialist employees on L visas; international investors on E visas; and persons with outstanding and extraordinary ability on O visas. For further information, see the **Appendix**, “Other High-Skilled Temporary Employment Categories.”

Pathways to Legal Permanent Residence

The H-1B visa and OPT often provide the link for foreign students to become employment-based LPRs. Many anecdotal accounts tell of foreign students who are hired by U.S. firms as they are completing their programs. The employers obtain H-1B visas for the recent graduates or hire them as OPT to extend their F-1 visas. According to the DHS: “This extension of the OPT period for STEM degree holders gives U.S. employers two chances to recruit these highly desirable graduates through the H-1B process, as the extension is long enough to allow for H-1B petitions to be filed in two successive fiscal years.”²³ If the temporary foreign workers meet expectations, the employers may also petition for them to become LPRs through one of the employment-based immigration categories.²⁴

Over 90% of 140,000 employment-based LPRs annually are adjusting to LPR status within the United States rather than newly arriving from abroad. Presumably, many of these foreign nationals had originally entered the United States as foreign students or temporary workers. Most foreign nationals seeking to qualify for a nonimmigrant visa, however, must demonstrate that they are not coming to reside permanently. Temporary workers who are H-1B visa holders are permitted to petition for a LPR visa at the same time that they file for an H-1B visa, a policy exception known as dual-intent.²⁵

Permanent Employment-based Admissions

Admissions and adjustments for LPR status are subject to a complex set of numerical limits and preference categories that give priority for admission on the basis of family relationships, needed skills, and geographic diversity. The INA establishes an annual worldwide level of 140,000 employment-based preference immigrants, and that ceiling includes the accompanying spouse and children in addition to the principal (i.e., qualifying) alien.²⁶ The employment-based preference categories are as follows:

²³ U.S. Citizenship and Immigration Services, *Extension of Post-Completion Optional Practical Training (OPT) and F-1 Status for Eligible Students under the H-1B Cap-Gap Regulations*, U.S. Department of Homeland Security, April 2, 2010.

²⁴ Not all companies, however, seek to convert H-1B employees to LPR status. Research by Professor Ron Hira of the Rochester Institute of Technology indicates that many of the largest users of the H-1B visa sponsor few, if any, of their H-1Bs for permanent residency. U.S. Congress, Senate Committee on the Judiciary, Subcommittee on Immigration, Refugees and Border Security, *The Economic Imperative for Enacting Immigration Reform*, 112th Cong., 1st sess., July 26, 2011.

²⁵ The other categories permitted dual intent are intracompany transfers employed with international firms who enter on L visas and foreign nationals with V visas for family-related nonimmigrant. §214(b) of the INA; 8 U.S.C. §1184(b).

²⁶ Numbers not used in one category roll down to the next category. CRS Report RL32235, *U.S. Immigration Policy on Permanent Admissions*, by Ruth Ellen Wasem.

- *first preference*: 40,040 for priority workers who are persons of extraordinary ability in the arts, sciences, education, business, or athletics; outstanding professors and researchers; and certain multinational executives and managers;
- *second preference*: 40,040 for members of the professions holding advanced degrees or persons of exceptional ability;
- *third preference*: 40,040 skilled workers with at least two years training, professionals with baccalaureate degrees, and unskilled workers in occupations in which U.S. workers are in short supply;
- *fourth preference*: 10,000 for special immigrants who largely consist of religious workers, certain former employees of the U.S. government, and undocumented juveniles who become wards of the court; and
- *fifth preference*: 10,000 for investors who invest at least \$1 million (or less money in rural areas or areas of high unemployment) to create at least 10 new jobs.²⁷

The employment-based visas made up 14.2% of the total one million LPRs in FY2010.²⁸

Foreign nationals with STEM degrees may qualify under several of the preference categories, depending on their talent, educational attainment, expertise, and experience. Employers who seek to hire prospective employment-based immigrants through the second and third preference categories also must petition DOL on behalf of the alien. The prospective immigrant must demonstrate that he or she meets the qualifications for the particular job as well as the preference category. If DOL determines that a labor shortage exists in the occupation for which the petition is filed, labor certification will be issued. If there is not a labor shortage in the given occupation, the employer must submit evidence of extensive recruitment efforts in order to obtain certification.²⁹

From FY2000 through FY2009, 145,390 foreign nationals qualified as first preference principals, i.e., priority workers who are persons of extraordinary ability, outstanding professors and researchers or certain multinational executives and managers. Of these, 21% reported they were engaged in STEM occupations, using the broader NSF definition. As **Figure 7** depicts, almost half (49%) of the first preference principals reported executive, administrative or managerial professions.³⁰

As **Figure 7** illustrates, 61% of the second preference principals reported they were engaged in STEM occupations during FY2000-FY2009. The broader NSF definition of STEM fields was

²⁷ For examples of legislation in the 112th Congress that would amend the fifth preference to foster STEM graduates who are entrepreneurs, see H.R. 1114 and S. 565.

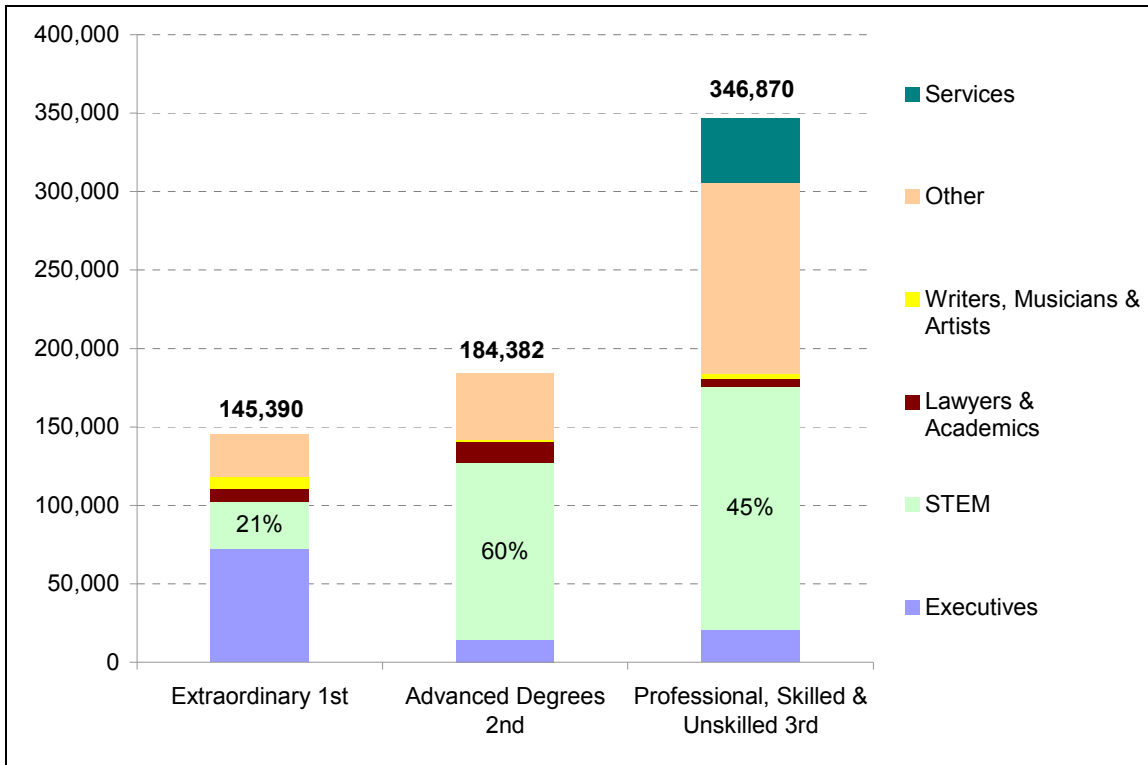
²⁸ Randall Monger and James Yankay, *U.S. Legal Permanent Residents: 2010*, U.S. Department of Homeland Security Office of Immigration Statistics, Annual Flow Report, March 2011, http://www.dhs.gov/xlibrary/assets/statistics/publications/lpr_fr_2010.pdf.

²⁹ See CRS Report RL33977, *Immigration of Foreign Workers: Labor Market Tests and Protections*, by Ruth Ellen Wasem.

³⁰ CRS analyzed the U.S. Department of Homeland Security Office of Immigration Statistics LPR data for fiscal years 2000 through 2009. There were a total of 10.3 million LPRs over the decade, of whom 69% reported an occupation. The occupation data analyzed in this report are the subset of 676,642 principal immigrants who received employment 1st, 2nd, or 3rd preference LPR status from fiscal years 2000 through 2009.

used for this analysis. In other words, STEM occupations dominated among the 184,382 foreign nationals who were admitted over this decade as members of the professions holding advanced degrees or persons of exceptional ability.

Figure 7. Occupations of 1st through 3rd Preference Employment-based Principals, FY2000-FY2009



Source: CRS analysis of data from the DHS Office of Immigration Statistics and the former Immigration and Naturalization Service.

Notes: STEM includes biological, agricultural, and environmental life sciences; computer and information sciences; mathematics and statistics; the physical sciences; psychology; the social sciences; engineering; and health fields.

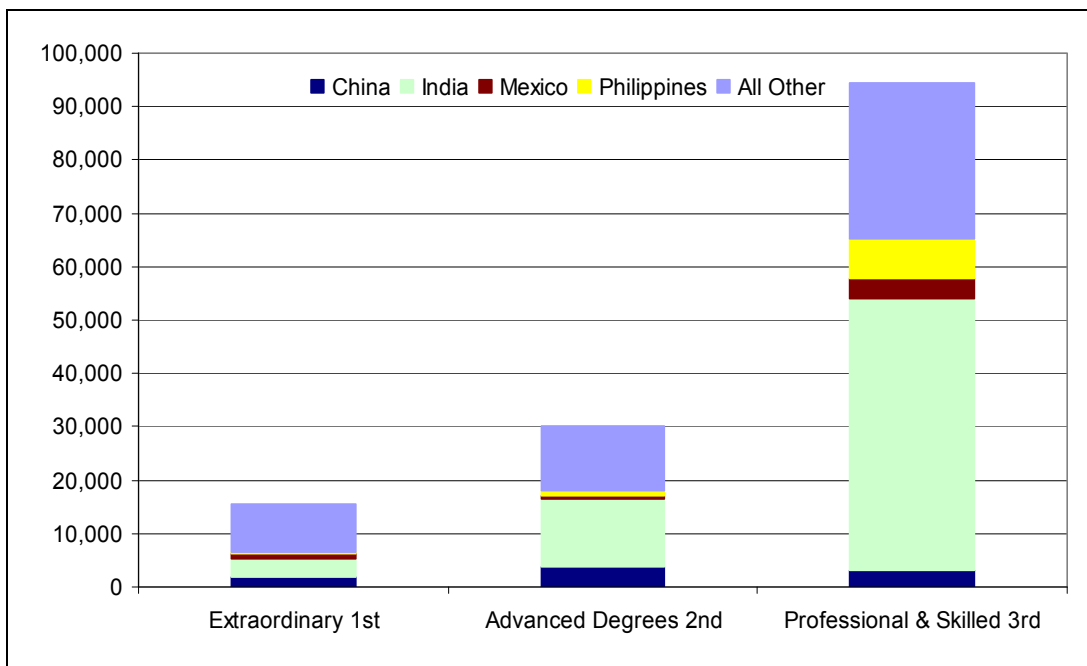
STEM occupations also made up a plurality of the third preference principals (i.e., skilled workers with at least two years training, professionals with baccalaureate degrees, or unskilled workers in occupations in which U.S. workers are in short supply). From FY2000 through FY2009, 45% of the 346,870 foreign nationals admitted as third preference principals reported they worked in STEM occupations.

In total, foreign nationals reporting STEM occupations made up 44% of all of the 676,642 LPRs who were employment-based principals in the first, second and third preference categories during the decade of FY2000-FY2009. Of all of the LPRs reporting STEM occupations (297,668) over this decade, 52% entered as third preference principals.

Employment-Based I-485 Applications Pending

The volume of employment-based immigration cases pending is an important factor in the STEM debate. The USCIS maintains a system of approved employment-based I-485 applications (i.e., the Application to Register Permanent Residence or Adjust Status) that are pending, which provides another source of data on the number of approved employment-based LPRs. Known as the I-485 Inventory, these data are available by preference category and by top countries. These I-485 data include the employment-based applicants who plan to adjust their immigration status within the United States. The prospective employment-based LPRs who would be new arrivals from abroad are not included in the I-485 inventory, because they would not need to file I-485 petitions.

Figure 8. Employment-Based I-485 Applications Pending January 2012 by Preference and Top Countries



Source: USCIS I-485 Inventory of pending cases, as of January 5, 2012.

Note: There were 140,245 cases; however, no “Professional and Skilled” (3rd) preference applications filed after August 2007 are included in the I-485 Inventory thus far.

As **Figure 8** shows, STEM graduates seeking LPR status are likely to wait in line to obtain LPR status, but those who meet the criteria of the extraordinary ability or advanced degrees preference categories have a much shorter wait. That there are no third preference I-485 applications filed after August 2007 in the I-485 Inventory suggests that USCIS has not been approving many since the 2007 visa retrogression pushed back the visa priority dates. These data likely understate the number of cases pending.³¹

³¹ A substantial visa retrogression occurred in July 2007. The *Visa Bulletin for July 2007* listed the visa priority dates as “current” for the employment-based preferences (except for the unskilled other worker category). On July 2, 2007, however, the State Department issued an *Update to July Visa Availability* that retrogressed the dates to “unavailable.” (continued...)

Legislative History of STEM Visas

Legislative proposals for STEM visas emerged during the debate over Comprehensive Immigration Reform in the mid-2000s. Various options aimed at retaining STEM graduates of American universities were folded into the legislation that was moving at the time. The approach was two-fold: (1) foster the recruitment and retention of STEM foreign students; and (2) enable foreign nationals with graduate degrees in STEM fields to adjust to LPR status without waiting in the queue of numerically-limited visas. Although the ideas for STEM visas continue to be discussed, legislative action on STEM visas stalled along with the broader Comprehensive Immigration Reform efforts in 2007.

During the 109th Congress, the Senate-passed Comprehensive Immigration Reform legislation (S. 2611) was the first piece of legislation with STEM visa provisions that received action. The legislation would have exempted from numerical limits foreign nationals who had worked in the United States for three years and who had earned an advanced degree in a STEM field. More specifically, §507 of S. 2611 as passed by the Senate would have permitted foreign students on a proposed STEM student visa to adjust to LPR status. Also, §508 would have allowed an unlimited number of foreign nationals who had earned an advanced degree in a STEM field and had been working in a related field in the United States during the three years preceding to become LPRs. The 109th House of Representatives did not pass comparable legislation.

In the 110th Congress, S.Amdt. 1150 to S. 1348, the Comprehensive Immigration Reform legislation that failed a cloture vote in the Senate, as well as H.R. 1645 (Security Through Regularized Immigration and a Vibrant Economy Act of 2007 or the STRIVE Act), similarly would have created STEM visas. The legislative proposals in the 110th Congress would have established a STEM foreign student visa category and would have permitted an unlimited number of foreign nationals who had earned STEM degrees and had been working in a related field in the United States during the three years preceding to become LPRs. Foreign students seeking STEM visas would not have needed to demonstrate an intent of departing the United States upon completion of their studies. Students in this category would have also been permitted to pursue Optional Practical Training for periods of up to 24 months after completing their degree. Employers would have been required to pay foreign students the higher of the average or prevailing wage in the field of employment.

Selected Legislation in the 112th Congress

There may be renewed interest in establishing STEM visas in the 112th Congress, and several bills have been introduced in both chambers. The House Committee on the Judiciary held two hearings on these issues in 2011.³² These issues also arose during the Senate Committee on the Judiciary

(...continued)

The State Department offered the following explanation: “The sudden backlog reduction efforts by Citizenship and Immigration Services Offices during the past month have resulted in the use of almost 60,000 Employment numbers.... Effective Monday July 2, 2007 there will be no further authorizations in response to requests for Employment-based preference cases.” U.S. Department of State, Bureau of Consular Affairs, *Visa Bulletin*, No. 108, is available at http://travel.state.gov/visa/frvi/bulletin/bulletin_3266.html.

³² U.S. Congress, House Committee on the Judiciary, Subcommittee on Immigration Policy and Enforcement, *H-1B Visas: Designing a Program To Meet the Needs of the U.S. Economy and U.S. Workers*, 112th Cong., 1st sess., March (continued...)

hearing on the economic rationale for immigration reform.³³ No legislation on STEM visas, however, has moved through committees as of the date of this report.³⁴

The Immigration Driving Entrepreneurship in America Act of 2011 or the IDEA Act of 2011 (H.R. 2161), the American Innovation and Education Act of 2011 (H.R. 3146), and the Science, Technology, Engineering, and Mathematics Visa Act of 2011 or STEM Visa Act of 2011 (S. 1986) while not identical, do include immigration provisions that are comparable in terms of STEM visas. The bills would amend the INA to establish a priority worker immigrant visa for an alien who has a qualifying: (1) master's or higher degree in a field of science, technology, engineering, or mathematics (STEM degree) from a U.S. institution of higher education; and (2) employment offer from a U.S. employer. S. 1986, H.R. 2161 and H.R. 3146 also would eliminate the foreign residency requirement for certain foreign students, enabling them to have dual intent.³⁵ The bills further would allow extensions of stay based upon a lengthy labor certification or priority adjudication for F-1 students, H-1B workers, and L intracompany transfers.

S. 1986, H.R. 2161 and H.R. 3146 would also amend the INA to impose a fee of \$2,000 per petition on an employer who files an application to hire a foreign worker. Certain not-for-profit and university-based employers would be exempt from paying the fee. Funds from the fees collected would be deposited in the STEM Education and Training Account, which the bills would establish in the Treasury. S. 1986, H.R. 2161 and H.R. 3146 furthermore would require that 60% of the funds be used for a STEM scholarship program for low-income U.S. students enrolled in degree programs in science, technology, engineering, or mathematics.³⁶

The Stopping Trained in America Ph.D.s From Leaving the Economy Act of 2011 or the STAPLE Act (H.R. 399) would amend the INA to exempt from: (1) direct numerical limitations aliens who have earned a Ph.D. degree in a STEM field from a U.S. institution of higher education and who have an offer of employment from a U.S. employer in a field related to such degree; and (2) H-1B visa numerical limitations aliens who have earned a Ph.D. degree in a STEM field from a U.S. institution, so long as that degree is required for the job the petitioning employer is filling.

The Startup Act of 2011³⁷ (S. 1965) would create a new conditional resident visa for up to 50,000 foreign students who have a master's or higher degree in a STEM field from a U.S. institution of

(...continued)

31, 2011; and U.S. Congress, House Committee on the Judiciary, Subcommittee on Immigration Policy and Enforcement, *STEM the Tide: Should America Try to Prevent an Exodus of Foreign Graduates of U.S. Universities with Advanced Science Degrees*, 112th Cong., 1st sess., October 5, 2011.

³³ U.S. Congress, Senate Committee on the Judiciary, Subcommittee on Immigration, Refugees and Border Security, *The Economic Imperative for Enacting Immigration Reform*, 112th Cong., 1st sess., July 26, 2011

³⁴ For a discussion of H.R. 3012, which would address high-skilled immigration by lifting the employment-based country ceilings, see CRS Report R42048, *Numerical Limits on Employment-Based Immigration: Analysis of the Per-Country Ceilings*, by Ruth Ellen Wasem.

³⁵ Dual intent refers to exceptions to §214(b) of the INA that permit foreign nationals to have pending petitions for both nonimmigrant and immigrant visas.

³⁶ For information on similar fees, see CRS Report RL31973, *Programs Funded by the H-1B Visa Education and Training Fee, and Labor Market Conditions for Information Technology (IT) Workers*, by Linda Levine and Blake Alan Naughton.

³⁷ Not to be confused with the StartUp Visa Act of 2011 (H.R. 1114/S. 565) which would amend the INA to establish an employment-based, conditional immigrant visa (StartUp visa) for a sponsored alien entrepreneur: (1) with required amounts of financial backing from a qualifying investor, government entity, or venture capitalist; and (2) whose commercial activities will generate required levels of employment, revenue, or capital investment.

higher education. The recipients of these new STEM visas would be granted conditional residence status contingent upon their remaining actively engaged in a STEM field for five consecutive years, after which they would be able to adjust to legal permanent resident status.

Policy Discussion

The fundamental policy question for Congress is: should the United States create additional pathways for STEM graduates to remain in the United States permanently? Some policy makers consider establishment of STEM visas to be a natural and positive chain of events, arguing that it would be inadvisable to educate talented young people only to make them leave to work for foreign competitors. Others maintain employment-based LPR admissions are highly skewed toward high-skilled immigrants, which already provide for generous flows of foreign nationals with STEM degrees. A corollary factor is that pulling prospective LPRs with graduate STEM degrees out of the numerically-limited employment-based categories would free up visas for the other prospective LPRs waiting in the employment-based queue. The policy discussion opens with two competing perspectives on the immigration prospects of international students with STEM degrees. Four themes of debate conclude the report: assessments of U.S. labor market needs; the competing definitions of STEM fields; the role of colleges and universities as gatekeepers; and the context of broader immigration reforms.

Two Perspectives on STEM Immigration Prospects

At the crux of the legislative debate is whether expedited immigration pathways for STEM foreign graduate students would be in the national interest, and two widely-cited studies of the issue are illustrative of this debate. The two studies featured below yield divergent findings, in large part because they use different research designs and study different STEM populations. This section does not purport to say that one research design is superior to another or that one target population is more meritorious than the others. Rather, it offers two examples with distinct approaches to highlight the competing perspectives. One approach is from the vantage point of the immigration caseloads in the visa categories that STEM degree holders currently use to become LPR; it explores the question of how long would foreign nationals from China and India who have STEM degrees wait to become LPRs of the United States. The other approach is a retrospective analysis of the foreign nationals who earn doctorates in STEM fields; it addresses the issue of retention rates of foreign STEM doctorates in the United States 10 years after graduation.

STEM Graduates Face Long Waits for LPR Status

A 2011 study by Stuart Anderson of the National Foundation for American Policy (NFAP) examined prospective LPRs with approved petitions to immigrate who were waiting in the queue for a numerically limited visa. Since the official data sources do not provide a complete total of cases in the pipeline, NFAP estimated some of the missing components.³⁸ The NFAP analysis of the data indicate that the majority of employer-sponsored LPRs at the end of 2010 were from India and China.

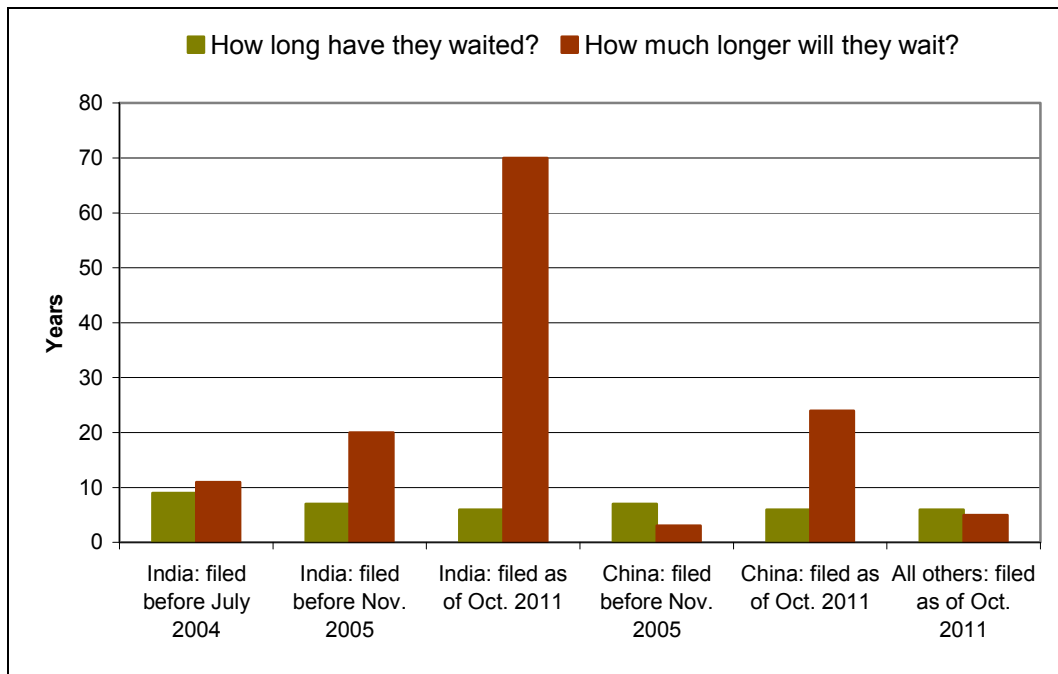
³⁸ For a full discussion of the data problems in estimating backlogs of approved petitions, see CRS Report R42048, *Numerical Limits on Employment-Based Immigration: Analysis of the Per-Country Ceilings*, by Ruth Ellen Wasem.

NFAP's Anderson estimated that a professional worker from India who applies for a professional and skilled (third preference) visa would wait approximately 70 years to obtain LPR status.³⁹

Figure 9 presents the NFAP estimates for the upper end, i.e., maximum number of years, that prospective LPRs have been waiting and might continue to wait for an LPR visa according to when they filed their petitions.

Figure 9. Projected Wait Times for Third Preference LPRs

Upper end NFAP estimates for professionals from India and China



Source: *Waiting and More Waiting: America's Family and Employment-based Immigration System*, Table 2, National Foundation for American Policy (NFAP), October, 2011.

Notes: Bars depict the upper end (i.e., maximum number of years) of the NFAP estimates.

The NFAP study of the pending caseload also estimated that a professional worker from China who applies for a third preference visa would wait approximately 24 years to obtain LPR status.⁴⁰ As **Figure 9** shows, the NFAP projected further that countries other than India and China would have wait times for a third preference of four to six years. Anderson concluded "America would lose much talent as U.S.-based businesses would need to hire or place such skilled individuals abroad, rather than invest in a green card process likely to last decades."⁴¹

³⁹ The study attempted to address the unknown cases pending who were waiting in the queue for a numerically limited visa and estimated that an additional 150,000 prospective LPRs from India were waiting in the professional and skilled worker preference queue. That estimate yielded a total of 210,000 Indians in the third preference caseload. Stuart Anderson, *Waiting and More Waiting: America's Family and Employment-based Immigration System*, National Foundation for American Policy, NFAP Policy Brief, October 2011. (Hereinafter Anderson, *Waiting and More Waiting: America's Family and Employment-based Immigration System*, NFAP Policy Brief, October 2011.)

⁴⁰ The study assumed that 55,000 Chinese were already in the third preference caseload. Anderson, *Waiting and More Waiting: America's Family and Employment-based Immigration System*, NFAP Policy Brief, October 2011.

⁴¹ Anderson, *Waiting and More Waiting: America's Family and Employment-based Immigration System*, NFAP Policy Brief, October 2011.

The NFAP study indicates that foreign nationals holding advanced degrees (second preference) face far shorter wait times. Only India and China are mentioned as having a noteworthy number of second preference cases pending. Indians and Chinese seeking second preference LPR visas today would have waits of approximately six years, according to the NFAP study.⁴²

NFAP's Anderson estimates that an exemption of 50,000 visas a year for foreign students with STEM graduate degrees would eliminate the backlog of cases for those holding advanced degrees (second preference) within two years. He further projects that it would ease the backlog of professional and skilled (third preference) workers, eliminating the backlog within 10 years.⁴³

Stay Rates of STEM Graduates Remain High

On-going research that Michael G. Finn has conducted for the National Science Foundation (NSF) on foreign nationals receiving science and engineering doctorates 10 years after graduation offers a different perspective. According to his latest published analysis, the 2009 stay rate for all foreign doctorate recipients was 64% for those graduating five years earlier and 66% for those graduating 10 years earlier. **Figure 10** has been reproduced from his report.⁴⁴

Finn found that the 2009 stay rate of doctorate recipients on temporary resident visas at the time of graduation behaved slightly differently for different cohorts. For those graduating five years earlier, the stay rate was down slightly from that recorded two years ago. However, for those graduating 10 years earlier, the stay rate in 2009 reached an all-time high. Finn concluded that stay rates for temporary foreign nationals receiving science and engineering doctorates overall have never been higher.⁴⁵

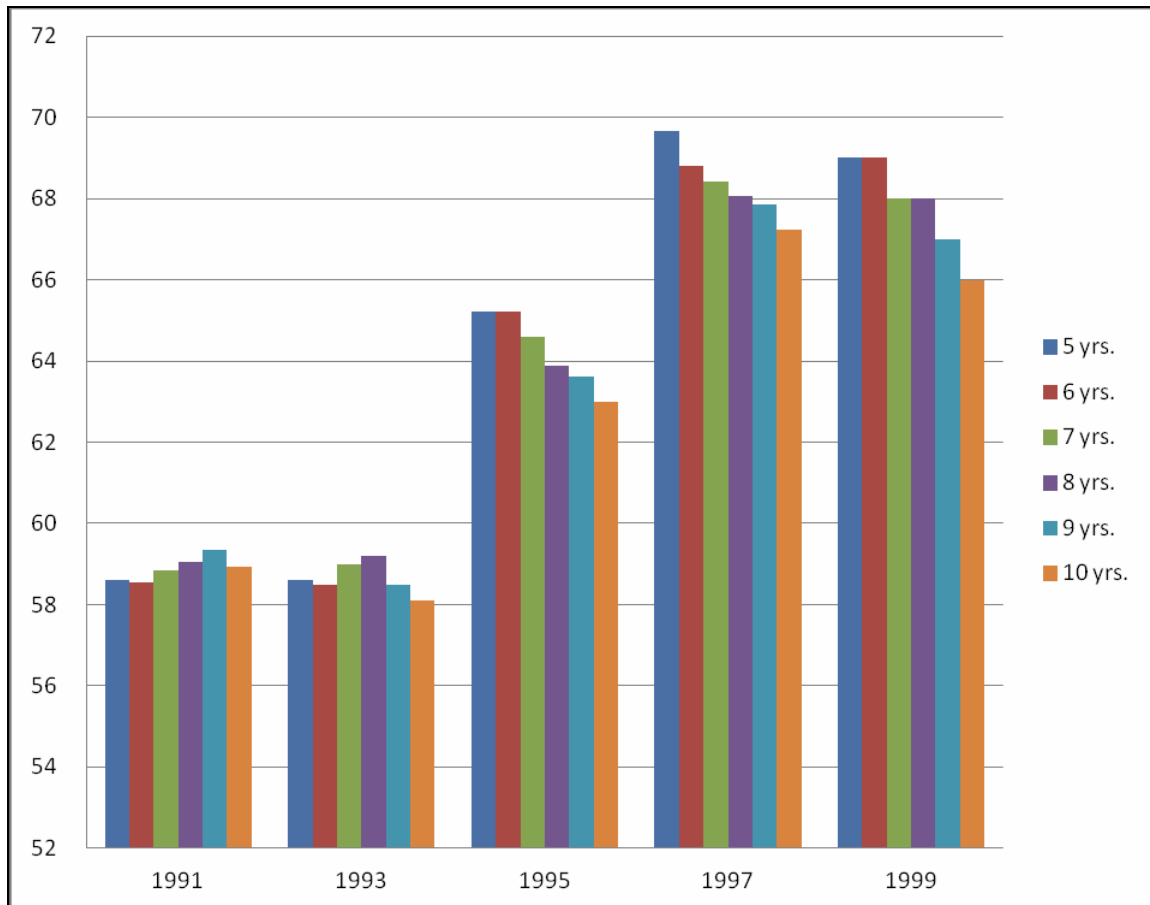
⁴² Anderson, *Waiting and More Waiting: America's Family and Employment-based Immigration System*, NFAP Policy Brief, October 2011.

⁴³ Anderson, *Waiting and More Waiting: America's Family and Employment-based Immigration System*, NFAP Policy Brief, October 2011. Anderson also factors in the calculation of removing the per-country ceilings on employment-based immigrants. For more on this option, see CRS Report R42048, *Numerical Limits on Employment-Based Immigration: Analysis of the Per-Country Ceilings*, by Ruth Ellen Wasem.

⁴⁴ Michael G. Finn, *Stay Rates of Foreign Doctorate Recipients from U.S. Universities, 2009*, Division of Science Resources Statistics of the National Science Foundation by Oak Ridge Institute for Science and Education through an interagency agreement with Department of Energy, January 2012, <http://orise.orau.gov/files/sep/stay-rates-foreign-doctorate-recipients-2009.pdf>. (Hereinafter Finn, *Stay Rates of Foreign Doctorate Recipients from U.S. Universities, 2009*.)

⁴⁵ Finn, *Stay Rates of Foreign Doctorate Recipients from U.S. Universities, 2009*.

Figure 10. Percentage of Foreign Nationals Receiving Science and Engineering Doctorates Who Were in the United States Five to 10 Years After Receipt of Doctorate, for Doctorates Awarded in 1991, 1993, 1995, 1997, and 1999



Source: reproduced from *Stay Rates of Foreign Doctorate Recipients from U.S. Universities, 2009*, by Michael G. Finn, January 2012.

Finn also studied prospective immigrants from India and China, and he reached this conclusion:

China and India are countries of special interest because they account for a large and growing share of new doctorate recipients and are subject to some restrictions not faced by most other countries when seeking permanent resident status. When comparing the history of stay rates for these two countries with that of all other countries, however, there is no apparent evidence that visa restrictions have reduced stay rates for China and India.⁴⁶

At first glance it seems difficult to reconcile Finn's conclusion about prospective LPRs from China and India, with Anderson's estimates of how long prospective LPRs from China and India might wait before visas would be available for them. From Anderson's perspective the wait times

⁴⁶ "While stay rates of India and China decline with years since graduation, this decline has been very slight and smaller than the corresponding decline in stay rates observed by all other countries combined." Michael G. Finn, *Stay Rates of Foreign Doctorate Recipients from U.S. Universities, 2009*, Division of Science Resources Statistics of the National Science Foundation by Oak Ridge Institute for Science and Education through an interagency agreement with Department of Energy, January 2012, <http://orise.orau.gov/files/sep/stay-rates-foreign-doctorate-recipients-2009.pdf>.

are too long for prospective employment-based immigrants in the professional and skilled category. From Finn's perspective, those with science and engineering doctorates have sufficient time and opportunity to become LPRs through one of the extraordinary ability or advanced degrees categories.

U.S. Labor Market Needs

A broad consensus of business, academic, and policy leaders warn that the United States is on the verge of STEM workforce shortages, which will diminish U.S. global economic competitiveness. Some analysts warn that without retaining more STEM graduates, the United States would suffer a loss of entrepreneurship, would decline in the knowledge economy, and would lose its premier place in the world of innovation. Proponents of STEM visas cite the substantial contributions of foreign-born residents in the United States to international patent creation (25.6% in 2006). "If we don't keep the skilled people in this country after they are educated in our universities and our institutions," U.S. Chamber of Commerce President Tom Donohue said, "companies have a simple choice: If we can't get them here and they go somewhere else, we send the work to where they are." The perspective of many in the business community is that skilled immigrants make jobs rather than take jobs.⁴⁷

Some researchers maintain that creating a STEM visa would not be prudent at this time, given the soft labor market for some STEM occupations. To support this argument, they point out that the unemployment rate of 5.2% for computer and mathematical occupations was greater than the 4.7% unemployment rate of college graduates generally in 2010, and that the unemployment rate of chemists and material scientists reached its highest level in 40 years in 2011 (6.1%).⁴⁸ Earlier research from 2007 found that STEM shortages were either overstated or misunderstood. One scholar testified about research indicating that some employers already use high-skilled temporary visa categories to recruit foreign workers at below market rates. This researcher also argued that employers have undue control over the temporary foreign workers because their legal status hinges on their employment. One study found that universities in the United States actually graduate many more STEM students than are hired each year. In 2011, a policy researcher testified that the science and engineering labor force has a substantial supply and that it is best characterized as a loose (not tight) labor market.⁴⁹

⁴⁷ National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*, Committee on Prospering in the Global Economy of the 21st Century, 2007; Brookings Institution and George Mason University, *Immigration Policy: Highly Skilled Workers and U.S. Competitiveness and Innovation*, Forum hosted by the Brookings Center for Technology Innovation and the George Mason Center for Science and Technology Policy, February 7, 2011; Vivek Wadhwa, Guillermina Jasso, and Ben Rissing, et al., *Intellectual Property, the Immigration Backlog, and a Reverse Brain-Drain, part III*, Duke University, New York University, Harvard Law School and the Ewing Marion Kauffman Foundation, August 2007; U.S. Congress, House Committee on the Judiciary, Subcommittee on Immigration Policy and Enforcement, *H-1B Visas: Designing a Program To Meet the Needs of the U.S. Economy and U.S. Workers*, 112th Cong., 1st sess., March 31, 2011; U.S. Congress, House Committee on the Judiciary, Subcommittee on Immigration Policy and Enforcement, *STEM the Tide: Should America Try to Prevent an Exodus of Foreign Graduates of U.S. Universities with Advanced Science Degrees?*, 112th Cong., 1st sess., October 5, 2011; and, Mallie Jane Kim, "Chamber of Commerce, Bloomberg Push Immigration Reform," *U.S. News & World Report*, September 28, 2011.

⁴⁸ U.S. Congress, Senate Committee on the Judiciary, Subcommittee on Immigration, Refugees and Border Security, *The Economic Imperative for Enacting Immigration Reform*, answers to questions for the record, witness Professor Ron Hira, 112th Cong., 1st sess., July 26, 2011; and Rudy M. Baum, "Unemployment Data Worst In 40 Years," *Chemical and Engineering News*, March 21, 2012.

⁴⁹ Richard Freeman, "The Market for Scientists and Engineers," *NBER Reporter*, no. 3 (Summer 2007); Rudy M. (continued...)

Defining/Refining STEM Fields

As noted at the onset, there is no consensus on the definition of STEM fields within academia or federal agencies. Concerns have been expressed that linking LPR status to a STEM degree without a clearly accepted definition might well have unintended consequences. For example, as a result of revisions in federal Standard Occupational Classification (SOC) in STEM occupations, there was a significant reclassification of employees. Roughly 5% of jobs in the U.S. labor force currently are considered STEM positions. The broader the STEM fields are defined, the more likely that no critical discipline would be omitted; however, a broad definition, some maintain, would also be more susceptible to gaming and abuses.⁵⁰

Others point out that even the narrowest definition would include widely heterogeneous disciplines with widely varied labor market conditions. For example, the engineering profession, which has evolved and splintered into sub-specialties over time, was defined in 1993 as follows:

Civil engineers had more specialized training as structural engineers, dam engineers, water-power engineers, bridge engineers; mechanical engineers as machine-design engineers, industrial engineers, motive-power engineers; electrical engineers as power and communication engineers (and the latter divided eventually into telegraph, telephone, radio, television, and radar engineers, whereas the power engineers divided into fossil-fuel and nuclear engineers); mining engineers as metallic-ore mining engineers and fossil-fuel mining engineers (the latter divided into coal and petroleum engineers).⁵¹

Today, engineering also encompasses such professions as computer engineers designing microchips that use light pulses and biomedical engineers researching the structure of human cells to foster tissue growth. To deal with the issue of defining STEM fields, one witness during a 2011 House hearing recommended first clarifying the policy motivations for the immigration benefit

(...continued)

Baum, "Unemployment Data Worst In 40 Years," *Chemical and Engineering News*, March 21, 2012; U.S. Congress, Senate Committee on the Judiciary, Subcommittee on Immigration, Refugees and Border Security, *The Economic Imperative for Enacting Immigration Reform*, answers to questions for the record, witness Professor Ron Hira, 112th Cong., 1st sess., July 26, 2011; U.S. Congress, House Committee on the Judiciary, Subcommittee on Immigration Policy and Enforcement, *H-1B Visas: Designing a Program To Meet the Needs of the U.S. Economy and U.S. Workers*, testimony of Professor Ron Hira, 112th Cong., 1st sess., March 31, 2011; and, U.S. Congress, House Committee on the Judiciary, Subcommittee on Immigration Policy and Enforcement, *STEM the Tide: Should America Try to Prevent an Exodus of Foreign Graduates of U.S. Universities with Advanced Science Degrees*, testimony of Dr. B. Lindsey Lowell, 112th Cong., 1st sess., October 5, 2011.

⁵⁰ "The large decline in the numbers of people who used to be grouped in this field is that the definition of "computer scientists and systems analysts" has become much more precise, and many of the people who might have been included in the more broadly defined profession during the 1990s are now grouped elsewhere under numerous new occupational titles for specialized types of information technology people, such as software engineers, network analysts, and database administrators." Richard Ellis, *Effects of Recent Revisions in Federal Standard Occupational Classification (SOC) Categories on Counts of the Employment of STEM Professionals*, Commission on Professionals in Science and Technology, May 2, 2007, <http://www.cpst.org/NewPubs.cfm>; Robert D. Atkinson, "Why the Current Education Reform Strategy Won't Work," *Issues in Science and Technology*, Spring 2012, pp. 29-36; and U.S. Congress, House Committee on the Judiciary, Subcommittee on Immigration Policy and Enforcement, *STEM the Tide: Should America Try to Prevent an Exodus of Foreign Graduates of U.S. Universities with Advanced Science Degrees?*, testimony of Barmack Nassirian, 112th Cong., 1st sess., October 5, 2011.

⁵¹ Joseph W. Barker, *McGraw-Hill Encyclopedia of Engineering*, ed. McGraw-Hill, 2nd ed. (1993), pp. 409-410.

and then assigning the task of enumerating eligible fields to an agency or inter-agency work-group as an option.⁵²

Confounding the discussion of what disciplines should be considered “STEM fields” is the perspective that STEM degrees are not as important as competency in a core set of STEM-based capabilities (referred to as STEM competency). There is an increasing demand for STEM competency in non-STEM occupations, which enables many people with STEM competencies to choose higher-paying career options in other fields. One report finds that out of every 100 students with a bachelor’s degree, 19 graduate with a STEM degree but only eight are working in STEM occupations ten years after graduation.⁵³

Colleges and Universities as Immigration Gatekeepers

Proponents of STEM visa legislation assert that completion of a graduate degree in a STEM field at a U.S. institution is an excellent criterion for selecting LPRs. They argue that the United States should not be sending back the world’s brightest students after educating them. They maintain that current policy not only fosters a reverse brain drain from our economy, but it also equips nations who compete with the United States in the global economy with graduates trained by our world-class universities. A witness at a 2011 hearing on STEM visas testified that a significant majority of foreign students—85% of Indian and Chinese students and 72% of European students—reported concerns about obtaining work visas. The witness warned that the United States was falling behind in the global competition for talent.⁵⁴

Other policy makers question the potential consequences of linking LPR status to student visas. For example, the Chairman of the House Committee on the Judiciary warned that establishment of STEM visas would create an incentive for some schools to recruit tuition-paying foreign students with the lure of LPR status upon graduation and cited reports from Australia, where some institutions of higher education were deemed to be “selling education for visas.” Another study of the unintended consequences of Australia’s linkage of its skilled migration program with international students reported “the failure of some former overseas students to achieve employment outcomes that were commensurate with their qualifications; and failure to obtain skill levels that would meet Australia’s skill needs.” Further concerns are the possibilities that the incentive of STEM visas may lead to foreign nationals displacing qualified American students or may lead to an over-production of advanced STEM degrees. Some experts advise that institutional eligibility should be carefully defined to prevent “diploma mills” from cashing in on the STEM visas and offer options such as limiting the eligible institutions to those requiring

⁵² U.S. Congress, House Committee on the Judiciary, Subcommittee on Immigration Policy and Enforcement, *STEM the Tide: Should America Try to Prevent an Exodus of Foreign Graduates of U.S. Universities with Advanced Science Degrees?*, testimony of Barmack Nassirian, 112th Cong., 1st sess., October 5, 2011.

⁵³ “At the graduate degree level of educational attainment, it is clear that both Managerial and Professional occupations and Healthcare Professional occupations pay substantially more than STEM.” Anthony P. Carnevale, Nicole Smith, and Michelle Melton, *STEM: Science, Technology, Engineering, Mathematics, Georgetown University Center on Education and the Workforce*, October 2011, V=<http://cew.georgetown.edu/stem/>.

⁵⁴ U.S. Congress, Joint Economic Committee, *Fueling Local Economies: Research, Innovation and Jobs*, testimony of Robert Litan, 111th Cong., June 29, 2010; U.S. Congress, House Committee on the Judiciary, Subcommittee on Immigration Policy and Enforcement, *STEM the Tide: Should America Try to Prevent an Exodus of Foreign Graduates of U.S. Universities with Advanced Science Degrees?*, testimony of Vivek Wadhwa, 112th Cong., 1st sess., October 5, 2011.

residency at the institution or receiving research funding from NSF or the National Institutes of Health.⁵⁵

Context of Broader Immigration Reform

The challenge in formulating an immigration system is structuring it to represent the country's values, priorities and needs. The difficulty is designing a system that operationalizes these specific values, priorities, and needs into immigration policy. STEM visas are appealing to some because they offer an option that appears to be solely merit-based. Yet, such specification of merit itself provokes debate over what human capital, personal traits, and values prospective immigrants should bring to a country. Some maintain that the STEM visas legislation has broad enough support to be enacted without tackling the thornier issues that confound comprehensive immigration reform, such as the immigration status of unauthorized students who were brought to the United States as children by their parents.⁵⁶ Others maintain it merely begs the question by increasing legal immigration without addressing wider reforms.

⁵⁵ U.S. Congress, House Committee on the Judiciary, Subcommittee on Immigration Policy and Enforcement, *STEM the Tide: Should America Try to Prevent an Exodus of Foreign Graduates of U.S. Universities with Advanced Science Degrees?*, 112th Cong., 1st sess., October 5, 2011; Elsa Koleth, *Overseas Students: Immigration Policy Changes 1997–May 2010*, Parliament of Australia, Parliamentary Library Background Note, June 18, 2010, <http://www.aph.gov.au/binaries/library/pubs/bn/sp/overseasstudents.pdf>.

⁵⁶ For a complete analysis of these immigration issues, see CRS Report R41704, *Overview of Immigration Issues in the 112th Congress*, by Ruth Ellen Wasem; and CRS Report R42036, *Immigration Legislation and Issues in the 112th Congress*, coordinated by Andorra Bruno.

Appendix. Other High-Skilled Temporary Employment Categories

Cultural Exchange Workers: J Visas⁵⁷

The broadest category for cultural exchange is the J visa, which includes professors and research scholars, students, foreign medical graduates, teachers, resort workers, camp counselors and au pairs who are participating in an approved exchange visitor program. U.S. Department of State's Bureau of Educational and Cultural Affairs (BECA) is responsible for approving the cultural exchange programs. J visa holders are admitted for the period of the program. Many foreign nationals on J-1 visas are permitted to work as part of their cultural exchange program participation. The J cultural exchange visas have expanded over time from visas issued for educational, research or scholarship purposes to visas issued for programs engaged in more mundane tasks, such as child care, resort work, or camp counseling. Today, the J visas may be issued to over a dozen subcategories of exchange visitors. Many of the J visa holders are coming to work in the United States, and some may be employed in STEM fields.

Multinational Executive and Specialist Employees: L Visas

Intracompany transferees who are executive, managerial, or have specialized knowledge, and who are employed with an international firm or corporation are admitted on the L visas. The prospective L nonimmigrant must demonstrate that he or she meets the qualifications for the particular job as well as the visa category. The foreign national must have been employed by the firm for at least six months in the preceding three years in the capacity for which the transfer is sought. The alien must be employed in an executive capacity, a managerial capacity, or have specialized knowledge of the firm's product to be eligible for the L visa. STEM graduates are most likely to fulfill the specialized knowledge element. The INA does not require firms who wish to bring L intracompany transfers into the United States to demonstrate that U.S. workers will not be adversely affected in order to obtain a visa for the transferring employee.

International Investors: E Visas

Aliens who are treaty traders enter on E-1 visas, whereas those who are treaty investors enter on E-2 visas. An E-1 treaty trader visa allows a foreign national to enter the United States for the purpose of conducting "substantial trade" between the United States and the country of which the person is a citizen. An E-2 treaty investor can be any person who comes to the United States to develop and direct the operations of an enterprise in which he or she has invested, or is in the process of investing, a "substantial amount of capital." Entrepreneurial STEM graduates, in

⁵⁷ The Q visa is also an employment-oriented cultural exchange program. Its stated purpose is to provide practical training and employment as well as to share the history, culture, and traditions of the United States and of the exchange visitor's home country. While STEM graduates are not typically recruited in Q exchange programs, they are not precluded.

particular, may utilize the E-2 visa. Both these E-class visas require that a treaty exist between the United States and the principal foreign national's country of citizenship.⁵⁸

Persons with Outstanding and Extraordinary Ability: O Visas

Persons with extraordinary ability in the sciences, arts, education, business, or athletics can be admitted on O visas. Generally, the O visa is reserved for the highest level of accomplishment and covers a fairly broad set of occupations and endeavors, including athletics and entertainment. Regulations implementing the O-1 visa define extraordinary ability in the field of science, education, business, or athletics as “a level of expertise indicating that the person is one of the small percentage who have arisen to the very top of the field of endeavor.”⁵⁹ In FY2010, the State Department issued 8,589 O-1 visas.

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⁵⁸ See CRS Report RL33844, *Foreign Investor Visas: Policies and Issues*.

⁵⁹ 8 C.F.R. §214.2(o)(3)(ii).