

# *Managing the Dynamic Science and Engineering Labor Market in the United States*

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The five million workers employed in science and engineering (S&E) occupations, and the 20 million with S&E degrees, are considered keys to U.S. competitiveness in the 21st century. Most of those earning PhDs in engineering at U.S. universities are foreigners, as are many of those earning PhDs in science. Many U.S. employers assert that the U.S. Government impairs economic competitiveness with policies that force some foreigners who earn advanced degrees from U.S. Universities to leave and restrict admissions of H-1B temporary foreign workers and that employers want to hire.

President Barack Obama and Republican challenger Mitt Romney disagree about most immigration-related issues, but both support allowing foreign S&E graduates to stay in the U.S. and increasing the number of visas for highly skilled science, technology, engineering, and mathematics (STEM) workers that U.S. employers want to hire. Microsoft's Bill Gates, referring to foreign S&E workers, testified in March 2007 that "America will find it infinitely more difficult to maintain its technological leadership if it shuts out the very people who are most able to help us compete," while former Federal Reserve Chair Alan Greenspan testified in April 2009 that the quota on H-1B visas was "far too small to meet the need." (Migration News, 2009).

To consider intersections among U.S. economic, labor, and immigration policies, the roundtable discussion, "Dynamics of the S&E Labor Market and Migration Management," was convened at Georgetown University in July 2012, organized by the Institute for the Study of International Migration, Georgetown University, and the Comparative Immigration & Integration Program, University of California, Davis, with support from the Alfred P. Sloan Foundation.

A group of 30 researchers and practitioners addressed the central question: Should the government simply raise the quota for foreign S&E workers or link their admission to the ever-changing demand for S&E workers? Four major issues were explored:

- 1 Do U.S. students respond to wage signals and move into S&E fields where earnings are rising and away from fields with declining earnings?
- 2 Are foreigner scientists and engineers more innovative and entrepreneurial than native born S&E professionals?
- 3 How could the U.S. Government improve the allocation of immigrant and temporary worker visas for employers?
- 4 Could an expert commission monitor U.S. labor markets and adjust the number of employment-related temporary and immigrant visas better than the current system, which fixes quotas in law?

The major lesson of the discussion was skepticism about the sweeping generalizations often made about the “need” for more foreign S&E students and workers. The data and objective analyses do not support sweeping calls for major changes in S&E-related migration policies at this time.

### *S&E STUDENTS AND SIGNALS*

It is sometimes said that scientists create knowledge, engineers apply knowledge, and engineering innovations can enable new scientific discoveries. U.S. students are interested in S&E, many earn S&E degrees, but far fewer ever work in S&E occupations. Why is there so much attrition or “diversion” from S&E interests and degrees to non-S&E occupations?

There are many reasons why individuals do not work in or move away from S&E occupations, including the fact that many engineers and life scientists urge their children not to enter these fields. Engineering is a cyclical industry, laying off workers in downturns and preferring to hire fresh graduates during booms, so that careers in engineering may be relatively short despite some of the highest starting salaries for fresh graduates. Those holding advanced degrees in the life sciences may work a decade or more as postdocs earning <\$50,000 a year before they find a “real” job, reducing their lifetime earnings.

High-ability students who can complete S&E degrees may elect to study business, law, or medicine, fields that offer higher lifetime earnings.

One study found that MBAs will earn \$1 million more than bioscientists graduating from the same university at the same time over their lifetimes and \$2 million more if stock options are included in the calculation (Teitelbaum, 2003). Students respond to market signals, as illustrated by the recent increase in enrollments in petroleum engineering, where entry-level wages topped \$85,000 in 2011, reflecting increased demand linked to oil shale projects. The number of U.S. students in petroleum engineering tripled in <3 years, evidence that rising wages attract students.

Those who nonetheless want the U.S. Government to expand the number of U.S. and foreign S&E students and workers agree that yes, wages and job opportunities influence student decisions on what to study and occupational choice, but S&E training is nonetheless fundamental to competitiveness and should be encouraged for its own sake. The National Academies (2007) *Rising Above the Gathering Storm* report asserted that U.S. schools “do not seem able to produce enough students...[for] domestic and world economies [that] depend more and more on science and engineering.” The authors of *Storm* and others acknowledge attrition from S&E occupations, but note that those trained in S&E fields may find jobs in health care or management. The unanswered question is whether more resources should be devoted to training in S&E if so many of those who receive degrees do not work in S&E occupations or soon leave them.

Government policies heavily influence the supply of and demand for S&E students and workers, especially for advanced degree holders. Government scholarships and research grants support much of the graduate education in S&E fields, and government spending in fields from space and defense to medicine and science shapes the demand for S&E workers with Masters and PhD degrees. Migration policy primarily affects supply, influencing admissions and support for S&E students and determining how many foreign S&E graduates can stay, and how many foreign S&E workers are admitted. Many S&E PhDs accept postdoc positions after graduation until they can find the academic and research jobs that they want.

### *ARE FOREIGNER SCIENTISTS AND ENGINEERS MORE INNOVATIVE?*

Even if U.S. students respond to S&E market signals and enroll in fields that offer rising salaries, there is another argument for opening doors

wider to foreign S&E students and workers: foreigners may be more innovative. Groups such as the Partnership for a New American Economy (2012) led by New York Mayor Michael Bloomberg argue that foreigners obtain patents at a higher rate than U.S.-born workers. President Obama has several times lamented the departure from the U.S. of foreign students who earned S&E degrees from U.S. universities, prompting proposals to “staple immigrant visas to degrees of foreign S&E graduates.”

A well-known statistic is that half of Silicon Valley start-ups have at least one immigrant co-founder. What is less well known is that two-thirds of the employees of Silicon Valley firms are foreign-born, which casts a different light on entrepreneurship and innovation among foreign-born U.S. residents. Studies of entrepreneurship and innovation agree that the more careful the study, the less likely the conclusion that immigrants are more entrepreneurial or more innovative than U.S.-born residents.

Many of the immigrants-are-innovative studies confuse composition and rates. About 13 percent of U.S. residents are foreign-born. However, the foreign-born comprise more than 13 percent of PhDs in the S&E fields where patents are most common, so it is no surprise that immigrants are associated with more than 13 percent of patents granted in S&E fields. If foreigners are more innovative or possess unique skills, they should be paid higher wages than comparable U.S. workers, but studies do not find that foreigners consistently receive a higher wage.

Similarly, immigrants are sometimes considered more entrepreneurial than U.S.-born residents, with entrepreneurship often measured by self-employment. However, a low-skilled worker whose lack of English encourages him to sell fruit from a cart is far different from a cofounder of a high-tech firm. The well-known role of foreign-born workers in Silicon Valley, a small but important slice of the U.S. economy, likely shapes impressions that the foreign-born are more innovative and entrepreneurial than natives.

### *ALLOCATING VISAS*

Sovereign governments regulate the entry and stay of foreigners. U.S. immigration law is complex, but both the study and employment provisions are led by U.S. institutions and employers who want to admit or employ particular foreigners, that is, private U.S. actors open doors to the U.S. for foreigners. Universities decide whom to admit, and foreigners use

their admission letters to obtain student visas, just as employers request employment visas for particular foreign workers. The government role is to say yes or no to particular requests.

The H-1B program provides 65,000 visas a year for foreigners with a Bachelor's degree, another 20,000 for foreigners who earned MS and PhD degrees from U.S. universities, and an unlimited number for universities and non-profits (the 65,000 cap was raised to 195,000 between 2001 and 2003). Between 2003 and 2007, employers requested all of the 65,000 H-1B visas for Bachelor's degrees soon after they were available, and urged congress to raise or abolish the H-1B quota. For FY13, which begins October 1, 2012, employers requested the 65,000 and 20,000 H-1B visas by June 2012.

All foreign graduates of U.S. universities are allowed to remain for 12 months after graduation to engage in Optional Practical Training (OPT), which is employment directly related to the student's field of study. After President Obama pointed to U.S.-trained S&E graduates having to leave the U.S. because there were too few H-1B visas available, DHS responded in April 2008 by extending OPT from 12 to 29 months for foreigners who earn degrees in STEM fields to give employers more opportunities to obtain H-1B visas for foreign STEM graduates, helping to alleviate the perceived "shortage" of STEM workers.

Critics of extended OPT for STEM graduates point to several issues, including the ever-expanding list of STEM occupations and the fact that employers of OPT foreigners do not pay social security and other payroll taxes on their wages, which may give some an economic incentive to hire foreigners over Americans. Critics also emphasize that, when U.S. quotas on H-1B visas are locked into international agreements such as the GATS, their number cannot be reduced even during recession without violating GATS commitments.

## *MANAGING MIGRATION*

The goals of U.S. migration policy include allowing employers to hire the workers they think best to fill particular jobs and to protect and enhance the wages of U.S. workers. Migration policy balances these competing interests by making it relatively easy for U.S. employers to hire foreign workers temporarily as guest workers and to obtain immigrant visas for settlers. At the same time, policy aims to protect U.S. workers by capping the number of visas available.

The question is whether there are better ways to (1) determine the number of visas to make available and (2) allocate them. The major proposal for determining numbers is an independent commission to study the labor market and recommend a number of immigrant and guest worker visas for a year or more, making adjustments as economic and labor market conditions change. Most proposals for a commission are long on how to appoint independent commissioners and the nature of their recommendations, but short on examples of how commission staff would use available top-down and bottom-up data and evidence to recommend the optimal number of visas.

A commission would likely look at why employers say there is a labor shortage that requires foreign workers and whether migration is a sensible response to perceived shortages. Deciding whether there is a labor shortage could involve looking at why the demand for labor exceeds supply, whether because demand increased faster than supply or whether supply responded slowly to increased demand due to required training or licenses, as with the extracting oil from shale that increased the demand for petroleum engineers. In some cases, the demand for S&E workers could be stable, but the supply could decrease with retirements and exits from the occupation. Finally, there could be restrictions on wages or training institutions that restrict entry into the occupation, as with a reported lack of instructors to train U.S. nurses.

Many labor shortage complaints reflect complexities that may not be optimally addressed by admitting more foreign workers. A commission, for example, might recommend that employers who complain of labor shortages increase recruitment efforts, raise the productivity of current workers, hire less-skilled workers and train them, or raise wages and improve benefits to attract more workers. In IT-related fields, some argue that employers who say they must hire foreigners who just graduated to access the latest skills may be masking the fact that younger workers generally earn lower wages and impose fewer benefit costs, which could be other reasons for preferring.

If the number of visas is fixed, how should they be allocated if demand exceeds supply? The U.S. now has a first-come, first-served procedure, with a lottery to select visa winners if all available visas are requested soon after they become available, as with H-1B visas in some years. Further frustrating employers, the current system does not allow them to establish a priority list of the foreigners for whom they are

requesting H-1B visas, so an employer requesting 10 H-1B visas may win visas for the 9th and 10th selections but not numbers one and two. Immigration lawyers reportedly opposed USCIS plans to allow employers to submit skeletal applications for H-1B visas and full applications only for those selected in the H-1B lottery, because such a two-step procedure could have *reduced* current fees that are typically \$3,000 per H-1B application.

Another way to allocate visas when demand exceeds supply is with auctions that award visas to the highest bidder. Auctioning visas could raise money for the government that now flows to immigration lawyers and advisors. Auctions raise operational questions, including whether there would be minimum or reservation fees, whether both employers and workers could bid for visas, and regulations to prevent gaming the auction, as when immigration advisors bid for visas to distribute to the employers who actually hire the workers. There are also concerns that auctions could lead to a form of indentured servitude, as employer auction fees were deducted from worker pay.

## CONCLUSIONS

S&E workers are important to U.S. competitiveness, and current policies to manage the entry of foreign S&E students and workers are debated. Employers want the government to make it easier for them to employ foreigners with S&E degrees by increasing the number of H-1B and related visas, while critics point to the large number of U.S. students who earn S&E degrees but do not work in S&E occupations.

There is considerable dissatisfaction with the current system for admitting S&E workers, but also skepticism that an expert commission could do better. Keeping quotas constant during the 2008–2009 recession, for example, was cited as an example of the problems of locking quotas into law. Employer requests for temporary foreign workers fell during recession, but not for employment-based immigration visas because of backlogs. The question is whether federal agencies and commissions that collect and analyze immigration and labor data can provide congress with the information needed to improve migration policy making, or whether a commission would be more efficient at collecting and analyzing data, or whether elected representatives accountable to voters are better decision makers than expert commissioners.

*REFERENCES*

Migration News.

2009 Unemployment, H-1B. Vol 16 No 4. October. <[http://migration.ucdavis.edu/mn/more.php?id = 3546\\_0\\_2\\_0](http://migration.ucdavis.edu/mn/more.php?id=3546_0_2_0)>.

National Academies.

2007 Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future. <[www.nap.edu/catalog.php?record\\_id = 11463#orgs](http://www.nap.edu/catalog.php?record_id=11463#orgs)>.

Partnership for a New American Economy.

2012 Patent Pending: How Immigrants are Reinventing the American Economy. <[www.renewoureconomy.org/patent-pending?](http://www.renewoureconomy.org/patent-pending/)

Teitelbaum, M.

2003 Do we need more scientists? The Public Interest. Fall. No. 153, Pp. 40-53. <<http://www.thepublicinterest.com/>>.