

Foreign-Origin Persons in the U.S. Information Technology Workforce

Data on the Information Technology Workforce

The purpose of the IT Workforce Data Project is to identify and disseminate trustworthy statistics on information technology workers in the United States. This report, the third in a series to be released in early 1999, looks at the employment of foreign-origin persons in U.S. information technology. Our previous reports provided a general overview of the IT workforce and examined the numbers of people with appropriate academic degrees. A fourth and final report will assess indicators of demand for people with IT skills.

In addition to printed reports, results from this project are available at the United Engineering Foundation's web site at www.uefoundation.org.

Queries about the IT Workforce Data Project are welcome. Contact Richard Ellis: (717) 532-3966 or email to ellis@cvns.net.

Sponsors

*The United Engineering Foundation
The Alfred P. Sloan Foundation*

Principal Investigators

*Richard Ellis, Ellis Research Services,
Shippensburg, Pennsylvania*

*B. Lindsay Lowell, Institute for the Study
of International Migration (ISIM),
Georgetown University*

Review Panel

*Tapan Mukherjee, National Science
Foundation (chair of the panel)*

*Frank Blecher, past chair, board of trustees,
United Engineering Foundation*

Michael Finn, Oak Ridge Associated Universities

Vin O'Neill, IEEE-USA

*Robert Weatherall, Office of
Career Services, MIT (retired)*

Acknowledgments

Our thanks and appreciation to Lawrence Burton of the National Science Foundation's Division of Science Resources Studies and Mary Collins of WESTAT, Inc., for the generation of statistics from NSF's SESTAT data base.

March, 1999

The first report in this series noted that Current Population Survey data for the first three quarters of 1998 yield an estimate of 2,084,000 persons employed in the "core" U.S. information technology (IT) occupations — computer scientists, computer engineers, systems analysts, and programmers. Seventeen percent (349,000) of these workers are foreign born,¹ compared to about 10 percent of the total U.S. population. The foreign born include naturalized citizens of the United States, noncitizens who are permanent residents of this country, and temporary residents with student or other kinds of limited-term visas. The count includes immigrants who arrived in the United States as children, well below the minimum civilian labor force age of 16.

Major immigration legislation in 1990 paved the way for a rise in the number of skilled permanent workers from abroad, starting in 1992. Many of these immigrants take IT jobs. The 1990 legislation also facilitated the entry of temporary specialty workers. In late 1998, Congress passed new legislation that further increases the number of temporary specialty workers who are permitted to work in the United States. Employers lobbied successfully to raise the number of skilled admissions, arguing that they needed access to the best and the brightest in a global economy, that they could not fill their needs for people with the available supply of U.S. workers, and that the then-existing limitation on the annual number of new temporary visas had been reached long before the end of the year.

These claims were controversial. Opponents cited reports from some older professionals with strong credentials for IT work who said that they could not obtain jobs, along with announcements of layoffs or plant closures from a number of IT employers, as evidence that the demand for IT specialists had been exaggerated. They argued that the interest displayed by employers in workers from abroad was occasioned less by superior talent than by a willingness on the part of foreign workers to work for lower pay (despite legal requirements to meet prevailing wages).²

Much of this debate took place with little reference to trustworthy information. This report addresses a need for better data to guide informed policymaking, providing information on the numbers and demographic characteristics of foreign-born IT workers. Its findings begin with the fact that while these workers are a substantial share of the IT labor force, that share is no more notable than the often greater share of foreign-born persons in some other scientific, engineering, or health-care occupations. In terms of their characteristics, foreign-born IT workers are similar to the natives in that they are predominately male. However, the similarity stops there. Foreign IT workers are substantially younger than their native counterparts, they are more likely to be Asian or Hispanic than white or African American, they are more educated, and most of them are found in just a few states.

¹ Children born abroad whose parents were U.S. citizens are *not* included among the "foreign born."

² The writers tracked these debates. A typical report is L. M. Sixel, "Prime time for programmers/Is software writing for the young?/Veterans say firms favor cheap labor," *Houston Chronicle*, May 27, 1998.

Data on foreign-born IT workers

The Current Population Survey (CPS) provides information on the nativity of IT workers as well as on their overall numbers and other demographic characteristics. Conducted by the Bureau of the Census for the Bureau of Labor Statistics, this is the premier source of data on the American labor force. The survey is based on a sample of 48,500 households, excluding persons in the armed forces and institutionalized living quarters. Data from detailed questions about the working status of everyone in these households are extrapolated to estimates for the entire U.S. civilian labor force (CLF) aged 16 or older residing in the 50 States or the District of Columbia.

Because the CPS covers most of the adult population of the U.S., its monthly samples of data contain relatively few cases for small subsets of that population like foreign-born IT workers. To create more robust estimates for those workers, data from the nine monthly CPS surveys done during the first three quarters of 1998 were merged for the analysis done for this report. This approach allowed a preview of the eventual final results from the CPS for 1998 (the work for this report was done in the Fall of that year), and also helped to minimize seasonal variations in the numbers.

Each source of labor force data is designed to serve different purposes, and results vary according to the particular objectives of each project. The outstanding feature of the CPS is that the data are obtained from sampled designated interviewees at each household. In contrast, other sources obtain data from surveys of establishments such as the Bureau of Labor Statistics' Occupational Employment Survey (OES), in which employers report the numbers of their people in different occupations, or from surveys of individual professionals conducted by mail or telephone (such as the National Science Foundation's Scientists and Engineers Statistical Data System, or SESTAT). Such differences of approach lead to differences in occupational estimates. For example, the OES yields lower numbers for "core" IT workers than does the Current Population Survey, because the survey of establishments uses a special occupational category, not found in the CPS, for "engineering,

science, and computer systems managers." SESTAT numbers are lower yet, because NSF does not consider programmers to be scientists or engineers and so its data base provides only partial coverage of that profession. Finally, different sources of information on IT workers also vary in their timing. These distinctions need to be kept in mind when viewing the data presented here and in other reports in this series.³

CPS data provide up-to-date information on foreign-born IT workers, but they do not support examination of further distinctions *within* this group between those who have become naturalized citizens of the United States, those who are permanent residents, and those who are here on temporary visas such as specialty "H-1B" workers. Some of those details are available for 1995 from SESTAT, and those older data are used here to provide additional information on different types of foreign-born people in the IT labor force.

Overall results from these sources are summarized in the table below. Among the foreign born, more than three out of five had become natural

ized U.S. citizens in 1995. Most of the remainder were permanent residents. Work by David North⁴ shows that a common path to citizenship begins with academic work in the United States. Employers recruit foreign students while they are here, helping them obtain H-1B or other visas for temporary workers. Later, applications may be made for permanent residence.

Demographic Characteristics

Foreign-born IT workers have some of the characteristics of most international migrants. As noted earlier, they are often young, male, and concentrated in a few states. More than 75 percent of all immigrants to the U.S. now come from Latin America and Asia, with roughly equal numbers from each region, but the IT immigrants are much more likely to be from Asia, with its larger supply of trained workers. Both high tech labor markets and immigration laws require immigrants who expect to work in information technology to be highly educated.

Among native IT workers, 28 percent are women. Fewer foreign-born IT specialists are female, 22 percent.

The average age of foreign-born IT workers is 35 years, fully three years younger than the native-born average of 38 years. Seventy-five percent of foreign-born IT workers

³ Our first report, *Core Occupations of the U.S. Information Technology Workforce*, includes a detailed examination of all of these sources of data and concludes that the CPS provides good estimates of the overall number of core IT workers. OES data from BLS and SESTAT statistics from NSF provide added details on the particular characteristics of this population.

⁴ *Soothing the Establishment: The Impact of Foreign-Born Scientists and Engineers on America* (Lanham, Maryland: University Press of America, 1995).

Nativity and Citizenship Status of Persons With Core Information Technology Jobs¹

| Nativity and Citizenship | 1998: Current Population Survey Data | | 1995: NSF SESTAT Data | |
|---------------------------|---|-------------|--------------------------|-------------|
| | Number | Percent | Number | Percent |
| Native-Born Citizens | 1,735,000 | 83% | 939,000 | 84% |
| Foreign Born | 349,000 | 17 | 176,000 | 16 |
| Naturalized Citizens | (N/A) | — | 108,000 | 10 |
| Permanent Residents | (N/A) | — | 55,000 | 5 |
| Temporary Residents | (N/A) | — | 13,000 | 1 |
| Total IT Workforce | 2,084,000 | 100% | 1,115,000 | 100% |

¹ For Current Population Survey data, jobs include computer scientists and engineers, systems analysts, and programmers. Many programmers are not included in the earlier SESTAT data. SESTAT also leaves out some foreign-origin persons. For example, people with foreign S&E degrees who came to the U.S. after 1990 are not included unless they earned a U.S. degree after they arrived in this country.

workers are under the age of 40; only 58 percent of native IT workers are in these younger age groups. In fact, foreign-born IT workers are younger than other foreign-born persons outside the information technology fields; nearly a third of the foreign-born people in the IT workforce are under the age of 30, compared to just under a quarter of the foreign-born persons in the rest of the labor force. Perhaps those in information technology are younger because of the nature of IT work, and because many foreign-origin IT workers are employed right out of U.S. colleges and universities, while many immigrants without high tech skills must stand in line for sponsorship by family members in the United States.

These data on age are included in the table below, along with additional numbers from SESTAT that show how age varies among naturalized citizens, permanent residents, and temporary residents. SESTAT's lack of complete coverage of programmers explains why IT workers in this NSF data base are older. Consequently, the gap between the ages of native and foreign-origin IT workers is not nearly as pronounced in the SESTAT statistics as it is in the more comprehensive CPS figures. What the SESTAT figures do reveal is the way that citizenship status shifts with age. Foreign-born IT workers covered by SESTAT are 38 years old, on the average. Those who have become naturalized citizens are older yet; it takes some time to become naturalized. The permanent residents average 37 years of age, while the

temporary residents are notably younger, averaging 30 years.

The racial and ethnic composition of the foreign-born IT labor force is radically different than that of the native-born. Native workers are mostly non-Hispanic whites, while foreign-born workers are predominately Asian with a strong representation of non-Hispanic whites. Hispanics are more common among the foreign born than they are among natives, while those with African ancestry are more common among persons born in the U.S. (see the table, top right).

The table in the middle of this page lists the six leading U.S. states of residence for native and foreign-born IT workers. The foreign born tend to live in just a few states, most of which have large concentrations of other immigrants. In contrast, the distribution of the native IT labor force seems to be influenced more by the location of IT employers. California leads the states in IT employment generally, and its concentration of foreign-born IT workers is higher yet; almost a fifth of them live there. Another fifth are split evenly between New York and Illinois. The leading three states account for 40 percent of the foreign-born IT workers, while it takes all six leading states to account for the same share of the native born. While Texas is the second leading state for native Americans, it falls outside the top 12 states for foreign IT workers, even though it ranks fourth as a home for the overall foreign-born population.

Race/Ethnicity of People With IT Jobs, by Nativity

| Group | Native Born | Foreign Born |
|--------------------|-------------|--------------|
| White Non-Hispanic | 87% | 30% |
| Black | 8 | 4 |
| Hispanic | 3 | 10 |
| Asian | 2 | 55 |
| All IT Workers | 100% | 99% |

Source: CPS. Components may not sum to totals because of rounding.

Leading States of Residence for People With IT Jobs, by Nativity

| Nativity and States | Percent |
|--------------------------|---------|
| I. Native Born: | |
| California | 12.5% |
| Texas | 7.5 |
| Virginia | 5.5 |
| Pennsylvania | 5.0 |
| Illinois | 5.0 |
| New York | 4.5 |
| Total, Top Six States | 40.0% |
| II. Foreign Born: | |
| California | 19.0% |
| New York | 11.0 |
| Illinois | 11.0 |
| Virginia | 7.5 |
| Florida | 6.5 |
| Massachusetts | 5.5 |
| Total, Top Six States | 60.5% |

Source: CPS. Components may not sum to totals because of rounding.

Age Distributions of Persons With Core IT Jobs, by Nativity and Citizenship Status

| Age Groups | 1998: Current Population Survey Data | | 1995: NSF SESTAT Data | | | | |
|----------------|--------------------------------------|--------------|-----------------------|------------------|----------------------|---------------------|---------------------|
| | Native Born | Foreign Born | Native Born | All Foreign Born | Naturalized Citizens | Permanent Residents | Temporary Residents |
| 16-29 | 22% | 30% | 13% | 15% | 11% | 11% | 59% |
| 30-39 | 36 | 45 | 41 | 45 | 39 | 57 | 37 |
| 40-54 | 36 | 23 | 40 | 36 | 44 | 30 | 4 |
| 55 and Older | 6 | 3 | 6 | 4 | 6 | 2 | — |
| All IT Workers | 100% | 101% | 100% | 100% | 100% | 100% | 100% |
| Mean Age | 38 | 35 | 39 | 38 | 40 | 37 | 30 |

¹ SESTAT data exclude many programmers and thus measure older workers. Components may not sum to exactly 100% due to rounding.

The CPS also asks the foreign born when they first arrived in the United States to stay. This is a problematic item; immigrants may not recall with accuracy, or may report a more recent year which they consider to be the start of their long-term intention to reside in this country. Nevertheless, the question is an approximate gauge of the year of immigration and the duration of stay. A little over a quarter of the foreign born report having come to the U.S. during the 1990's; another third report immigrating in the 1980's (see table, top right).

With regard to education, the nature of the IT industry and the immigration system results in a highly educated foreign-born IT workforce (see the table at the bottom of this page). Of course, the information technology industry does not always require an IT degree or other kinds of formal IT training; the hacker who starts a thriving business in his garage is the stuff of legend. Indeed, 36 percent of the native IT workers covered by CPS statistics have not achieved a four-year college degree, although a majority of those people have taken some college courses or have completed an associate or vocational degree. One might speculate that our technoculture, along with local accessibility to employers, marries highly motivated natives with little formal training to IT jobs. At the other end of the spectrum, though, 40 percent of the foreign-born IT workers have completed a masters or higher degree. Clearly, minimum skill requirements for permanent and temporary residents, along with the fact that often their U.S. educational experiences

make them accessible to employers, are encouraging the selection of college-trained foreign IT workers.⁵

These data show that on the average, foreign-born IT workers have formal training that outstrips native workers. This edge holds *within* the skills hierarchy of the industry. Foreign-born IT workers are as likely as natives to be in the more highly trained group of computer scientists, computer engineers, and systems analysts, compared to the group of programmers; the split between the two levels is about 70/30, respectively, for both natives and the foreign born. Thus despite speculation otherwise, foreign IT workers are not more likely than natives to be filling supposedly lower level programming positions.⁶ Regardless of the level, on the average the foreign born have about one more year of formal education than their native counterparts (see the table, middle right).

Foreign-born workers have become a significant source of labor for the U.S. information technology industry. Only about 10 percent of the world's

annual output of high-tech bachelor's degrees comes from this country,⁷ and the current level of admissions of foreign workers accounts for only a tiny fraction of this enormous global pool of trained persons. Thus these flows are likely to continue. The next and final report in this series will review measures of demand for all this talent.

⁷ See "The Global Production of New Engineers," *ENGINEERS* Vol. 1, No. 4 (October, 1995), pp. 1-8.

Year of Arrival of Foreign-Born IT Workers

| Year of Arrival | Percent |
|------------------------------------|-------------|
| 1990-1998 | 29% |
| 1980-1989 | 34 |
| 1970-1979 | 27 |
| 1969 or earlier | 10 |
| All Foreign-Born IT Workers | 100% |

Source: CPS. Components may not sum to totals because of rounding.

⁵ CPS sample sizes are too small to reliably estimate those with doctorates, but the data suggest that less than two percent of natives in the IT workforce have Ph.D.'s, while about seven percent of the foreign-born workers have them. SESTAT data yield similar results, at 2.3 percent and 7.0 percent, respectively (the figure for natives rises to 2.7 percent if advanced professional degrees such as J.D.'s and M.D.'s are counted); however, as noted elsewhere, SESTAT's data are for a much more highly selected population.

⁶ The first report in this series argues that at its highest levels, programming is an elite profession.

Years of Education and IT Occupations, by Nativity

| Occupation | Native Born | Foreign Born |
|---|-------------|--------------|
| <i>Years of Education, for:</i> | | |
| Computer Scientists, Computer Engineers, & Systems Analysts | 15.4 | 16.9 |
| Programmers | 14.9 | 15.8 |

Source: CPS; sample sizes are too small to support estimates from data on degree completions. These are rough estimates based on imputing category means and approximate years needed to complete degrees.

Education of Persons With Core IT Jobs, by Nativity and Citizenship Status

| Degrees Completed | 1998: Current Population Survey Data | | 1995: NSF SESTAT Data | | | | |
|-----------------------|--------------------------------------|--------------|-----------------------|------------------|----------------------|---------------------|---------------------|
| | Native Born | Foreign Born | Native Born | All Foreign Born | Naturalized Citizens | Permanent Residents | Temporary Residents |
| High School | 7% | 4% | — | — | — | — | — |
| Associate/Vocational | 29 | 11 | — | — | — | — | — |
| Bachelor's Degree | 48 | 45 | 75 | 51% | 61% | 40% | 21% |
| Master's or Higher | 15 | 40 | 25 | 49 | 39 | 60 | 79 |
| All IT Workers | 100% | 100% | 100% | 100% | 100% | 100% | 100% |

¹ SESTAT data are collected only for bachelor or higher-level college graduates and exclude many programmers, and so they measure more educated workers.