# HIGH-END IMMIGRANTS AND THE SHORTAGE OF SKILLED LABOR

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The 1990 Immigration Act (IMMACT) responded to claims of an impending shortage of skilled labor in the United States (Johnston and Packer, 1987) and to growing concerns that the skill levels of immigrant workers were falling farther and farther behind those of natives (Borjas, 1990, 1994). IMMACT raised the annual number of employment-based permanent resident visas from 54,000 to 140,000 and created a new temporary-worker category (H-1B) to permit U.S. employers to recruit skilled workers from abroad for professional "specialty occupations." The latter include, for example, computer programmers, engineers, medical professionals, and accountants.[1] H-1B workers must have at least a bachelor's degree or its equivalent, and they may remain in the United States for up to six years. In 1990 Congress decided to cap the number of newly admitted H-1B workers at 65,000 per year.

This ceiling proved sufficient for most of the 1990s, but the growing demand for H-1B workers created a visa shortage in fiscal year (FY) 1997 and again in 1998 (Martin, 1999).[2] The FY 98 ceiling was reached in May, and the Immigration and Naturalization Service reported that the cumulative backlog had reached at least 30,000 by the end of the fiscal year (National Conference of State Legislatures, 1998). Congress eased the annual quota on H-1B visas in October 1998 when it passed the American Competitiveness and Workforce Improvement Act. This act increased the number of temporary visas for highly skilled foreign workers to 115,000 in FY 99 and FY 00 and to 107,500 in FY 01 before returning to 65,000 in FY 02 and beyond.[3] However, more than 90,000 H-1B petitions subject to the new cap had been approved by the end of March 1999, and by June 1999 the larger supply was exhausted once again (Colon, 1999;

[1] IMMACT also created several other temporary visa categories. These include "O" for aliens with extraordinary ability in sciences, arts, and education, "P" for internationally recognized entertainers and athletes, "Q" for participants in international cultural exchange programs, and "R" for religious workers (Lowell, 1996; Papademetriou and Yale-Loehr, 1996).

[2] This rising demand represents a continuation from previous decades. Admissions of nonimmigrant or temporary workers across all occupations in categories that permit the individual to work legally rose from 96,000 in 1969 to 263,000 in 1990. However, there was a ten-fold increase in the number of scientists and engineers among these temporary workers (North, 1995).

[3] In addition, firms that rely heavily on H-1B visas must certify that foreign workers are not taking jobs from American workers. There is also a $500 fee per visa that will be used to fund training programs for U.S. students and workers (National Conference of State Legislatures, 1998).

Newhouse News Service, 1999). Sen. Phil Gramm (R-Texas) has said he plans to introduce legislation to boost the H-1B visa quota to 200,000 annually (Goldstein, 1999).

Controversy surrounds the question of whether a skilled-labor shortage truly exists. Immigration lawyers and leaders of high-tech industry argue that a “global war for talent” is emerging and that America needs to have access to the best and brightest workers anywhere in the world to maintain its global competitive edge (Judy, 1999; Burdette, 1999). This view is supported by the Hudson Institute’s *Workforce 2020* study (Judy and D’Amico, 1997) on the implications of an aging population for the supply of highly skilled workers, and by widely publicized reports from the U.S. Commerce Department (Office of Technology Policy, 1997) and the Information Technology Association of America (1997).

On the other hand, some professional engineering societies contend that high-tech industries that are complaining about skilled-labor shortages are often the same ones responsible for many of the layoffs of American workers (Federation for American Immigration Reform, 1998). The U.S. General Accounting Office (1998) has reported that the Commerce Department’s study alleging a shortage of information technology workers is so methodologically flawed that its conclusions should not be taken seriously. Previous studies that projected a shortfall of skilled labor have been contradicted by subsequent developments (Fechter, 1994). And, finally, the number of permanent resident visas issued since FY 92 in the employment-preference categories has fallen short of the allocated quota (Papademetriou and Yale-Loehr, 1996), and more than 40,000 of these visas (out of 140,000) went unused during FY 98 (Burdette, 1999).

Whether the U.S. labor force needs more high-tech immigrant workers can be debated. But one thing is clear. We do need more data about the size, shape, and growth of the science and engineering workforce in this country (U.S. General Accounting Office, 1998). IMMACT was passed with little regard for such information, and the higher quotas on H-1B visas were a

response more to pressure from special interest groups than to solid evidence of a skilled-labor shortage. Better data can contribute to better policy:

> The lack of adequate data, which inhibits the making of informed policy choices, often forces policy prescriptions to rely on anecdotal or plainly false "evidence," and enables those interested in making political arguments based on dubious facts to do so with relative impunity (Papademetriou and Yale-Loehr, 1996: 14).

This article provides new information on the growth and changing composition of the science and engineering (S&E) workforce in the United States from 1970 to 1997 and highlights the contribution of foreign-born scientists and engineers to these trends. The data come from the 1970 and 1990 decennial censuses and from the March 1997 Current Population Survey. We include in the S&E workforce all members of the civilian labor force who report a science or engineering occupation. Our universe of S&E occupations agrees with the definition used by the National Science Foundation in its Scientists and Engineers Statistical Data System (SESTAT).

Table 1 shows that the number of scientists and engineers increased by almost 150 percent between 1970 and 1997, growing from 2.0 million to 4.9 million. At the same time, the foreign-born share rose from 7.6 percent to 14.8 percent. The tempo of growth exhibited by the S&E population is strikingly different from that of the overall U.S. civilian labor force. Across the entire 27-year period, the average annual growth rate for the number of scientists and engineers is nearly double the rate for the total labor force (3.3 versus 1.8 percent). As a result, scientists and engineers increased their share of the labor force from 2.4 percent in 1970 to 3.6 percent by 1997 (U.S. Bureau of the Census, 1997). Moreover, the total U.S. labor force grew faster between 1970 and 1990 than it did in the 1990s (2.1 versus 1.1 percent per year), as the large baby boom cohorts were being absorbed into the labor market in the earlier period. By contrast, growth of the S&E workforce has been much more rapid in the 1990s than in the preceding two decades (5.5 versus 2.5 percent per year). Since 1990, the number of foreign-born scientists and engineers in the labor force has increased by nearly 10 percent per year.

Table 2 shows the distribution of the total S&E labor force across the five SESTAT major groups, including computer and mathematical sciences, life and related sciences, physical and related sciences, social and related sciences, and engineering. The number of people in each S&E category grew steadily between 1970 and 1997, but the patterns of growth were sharply dissimilar. Engineering's share fell from two-thirds to less than one-half, whereas the proportion of all scientists and engineers who reported themselves as computer or mathematical scientists rose from one in every eight in 1970 to one in three by 1997.[4] Although the distribution across S&E fields is quite similar for native- and foreign-born scientists and engineers, there were statistically significant nativity differentials in both 1970 and 1990. The foreign born were disproportionately concentrated in physical and related sciences, while natives had a greater presence in computer and mathematical sciences.

Reflecting trends in overall U.S. immigration, foreign-born scientists and engineers now come mainly from Asia, whereas Europe predominated in earlier decades. In 1970, for example, Germany, Canada, and England were the three leading source countries. China ranked fourth, and India ranked fifth. Today, India and China rank first and second and together account for one-quarter of all non-native scientists and engineers. The other three leading sending countries (Japan, Philippines, and Vietnam) are also in Asia. Finally, the pace of high-end immigration shows no signs of letting up. Approximately three in every ten foreign-born scientists and engineers in the country today arrived in the 1990s.

Does all this add up to a skilled-labor shortage? Apart from spot shortages that exist in any production process, longer-term labor shortages can only exist if there is some artificial mechanism that prevents wages from rising to a market-clearing wage. None of these mechanisms seems to be present in today's competitive labor markets. Rising wages or total

[4] Job switching or simply relabeling one's own occupation may account for some of the growth differences between engineering and computer and mathematical sciences. As economist John Bishop has noted, "Fortunately, most electrical engineers can do work in computer science. One reason computer science and

compensation would be one sign of growing labor scarcity. But scientists' and engineers' annual salaries, measured aggregately in constant dollars, have been falling (Espenshade and Usdansky, 1999). Perhaps the view of one labor economist comes closest to the heart of the matter: "If computer companies' response to difficulty in hiring at the existing wage is just to put out ads and not to raise salaries, then it is not surprising that they perceive some sort of shortage" (Kemmet and Widerquist, 1998: 7).

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systems analysis jobs were able to grow was people moved from electrical engineering into them" (quoted in Kemmet and Widerquist, 1998: 8).

**Table 1.** Number of Scientists and Engineers in the U.S. Civilian Labor Force, by Nativity: 1997, 1990, and 1970

| | ***1997*** | | ***1990*** | | ***1970*** | |
|---|---|---|---|---|---|---|
| *Nativity* | *Number* | *%* | *Number* | *%* | *Number* | *%* |
| Total | 4,917,100 | 100.0 | 3,345,600 | 100.0 | 2,026,400 | 100.0 |
| Native Born | 4,188,200 | 85.2 | 2,965,800 | 88.6 | 1,872,300 | 92.4 |
| Foreign Born | 728,900 | 14.8 | 379,800 | 11.4 | 154,100 | 7.6 |

**Table 2.** Scientists and Engineers in the U.S. Civilian Labor Force, by Occupation and Nativity: 1997, 1990, and 1970

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | **1997** | | | |
| | *Native Born* | | *Foreign Born* | | *Total* | |
| *Occupation* | *Number* | *%* | *Number* | *%* | *Number* | *%* |
| Total | 4,188,200 | 100.0 | 728,900 | 100.0 | 4,917,100 | 100.0 |
| Computer Science | 1,383,400 | 33.0 | 251,100 | 34.5 | 1,634,400 | 33.2 |
| Life Science | 244,300 | 5.8 | 46,200 | 6.3 | 290,500 | 5.9 |
| Physical Science | 270,400 | 6.5 | 34,500 | 4.7 | 304,900 | 6.2 |
| Social Science | 452,800 | 10.8 | 65,800 | 9.0 | 518,600 | 10.5 |
| Engineering | 1,837,300 | 43.9 | 331,300 | 45.5 | 2,168,600 | 44.1 |
| | | | **1990**[a] | | | |
| | *Native Born* | | *Foreign Born* | | *Total* | |
| *Occupation* | *Number* | *%* | *Number* | *%* | *Number* | *%* |
| Total | 2,965,800 | 100.0 | 379,800 | 100.0 | 3,345,600 | 100.0 |
| Computer Science | 700,400 | 23.6 | 80,800 | 21.3 | 781,200 | 23.4 |
| Life Science | 148,500 | 5.0 | 19,800 | 5.2 | 168,300 | 5.0 |
| Physical Science | 223,100 | 7.5 | 35,500 | 9.4 | 258,600 | 7.7 |
| Social Science | 351,700 | 11.9 | 27,500 | 7.2 | 379,300 | 11.3 |
| Engineering | 1,542,100 | 52.0 | 216,100 | 56.9 | 1,758,200 | 52.6 |
| | | | **1970**[a] | | | |
| | *Native Born* | | *Foreign Born* | | *Total* | |
| *Occupation* | *Number* | *%* | *Number* | *%* | *Number* | *%* |
| Total | 1,872,300 | 100.0 | 154,100 | 100.0 | 2,026,400 | 100.0 |
| Computer Science | 233,200 | 12.5 | 11,700 | 7.6 | 244,900 | 12.1 |
| Life Science | 113,600 | 6.1 | 10,300 | 6.7 | 123,900 | 6.1 |
| Physical Science | 165,700 | 8.8 | 22,700 | 14.8 | 188,400 | 9.3 |
| Social Science | 118,800 | 6.3 | 10,400 | 6.8 | 129,300 | 6.4 |
| Engineering | 1,241,000 | 66.3 | 99,000 | 64.2 | 1,339,900 | 66.1 |

[a]The nativity differential is significant at the 0.01 level.

REFERENCES


Borjas, George J. 1990. *Friends or Strangers: The Impact of Immigrants on the U.S. Economy*. New York: Basic Books, Inc.

Borjas, George J. 1994. "The Economics of Immigration," *Journal of Economic Literature*, December, 32(4): 1667-1717.

Burdette, Rebecca. 1999. "Testimony of Rebecca Burdette." Testimony to the U.S. House Judiciary Committee, Subcommittee on Immigration and Claims, Oversight Hearing on the Benefits to the American Economy of a More Educated Workforce, Washington, D.C., March 25.

Colon, Yves. 1999. "Technology Visa Program Hits Its Limit," *The Miami Herald*, June 15.

Espenshade, Thomas J. and Margaret L. Usdansky. 1999. "Migration of the Highly Skilled: Foreign-Born Scientists and Engineers in U.S. Labor Markets," paper presented at the annual meetings of the Population Association of America, New York, New York, March 25-27.

Fechter, Alan. 1994. "Future Supply and Demand: Cloudy Crystal Balls." Pp. 125-140 in Willie Pearson, Jr. and Alan Fechter, eds., *Who Will Do Science? Educating the Next Generation*. Baltimore: The Johns Hopkins University Press.

Federation for American Immigration Reform. 1998. "Congress Passes H-1B Foreign Worker Increase," *FAIR Immigration Report*, October, vol. 18, no. 8. Washington, D.C.

Goldstein, Alan. 1999. "Gramm to Seek More Tech Visas," *Dallas Morning News*, June 2.

Information Technology Association of America. 1997. *Help Wanted: The IT Workforce Gap at the Dawn of a New Century*, February. Arlington, VA: ITAA.

Johnston, William B. and Arnold E. Packer. 1987. *Workforce 2000: Work and Workers for the Twenty-first Century*. Indianapolis: Hudson Institute.

Judy, Richard W. 1999. "Immigration Policy and America's Workforce Needs: Re-establishing the Connection." Testimony to the U.S. House Judiciary Committee, Subcommittee on Immigration and Claims, Oversight Hearing on the Benefits to the American Economy of a More Educated Workforce, Washington, D.C., March 25.

Judy, Richard W. and Carol D'Amico. 1997. *Workforce 2020: Work and Workers in the 21st Century*. Indianapolis: Hudson Institute.

Kemmet, Lynndee and Karl Widerquist, eds. 1998. *Is There a Shortage of Information Technology Workers*? June 12, Symposium Proceedings. Annandale-on-Hudson, NY: The Jerome Levy Economics Institute of Bard College.

Lowell, B. Lindsay. 1996. "Temporary Visas for Work, Study, and Cultural Exchange: Introduction and Summary." Pp. 1-28 in B. Lindsay Lowell, ed., *Temporary Migrants in the United States*. Washington, D.C.: U.S. Commission on Immigration Reform.

Martin, Philip. 1999. “Shortages, Wages and Qualified Workers: Options for Dealing with Nonimmigrants.” Pp. 113-122 in Lydio F. Tomasi, ed., *In Defense of the Alien*, vol. XXI, 1998. New York: Center for Migration Studies.

National Conference of State Legislatures. 1998. “High-Tech Foreign Worker Visas Increased,” *Immigrant Policy News…Inside the Beltway*, November 6, vol. 5, no. 3. Washington, D.C.: Immigrant Policy Project, State and Local Coalition on Immigration.

Newhouse News Service. 1999. “High-Tech Visas Running Out Again,” *San Jose Mercury News*, May 13.

North, David S. 1995. *Soothing the Establishment: The Impact of Foreign-Born Scientists and Engineers on America.* New York: University Press of America, Inc.

Office of Technology Policy. 1997. *America’s New Deficit: The Shortage of Information Technology Workers*, September 29. Washington, D.C.: U.S. Department of Commerce.

Papademetriou, Demetrios G. and Stephen Yale-Loehr. 1996. *Balancing Interests: Rethinking U.S. Selection of Skilled Immigrants*. International Migration Policy Program, No. 4. Washington, D.C.: Carnegie Endowment for International Peace.

U.S. Bureau of the Census. 1997. *Statistical Abstract of the United States: 1997* (117th Edition), Washington, D.C.

U.S. General Accounting Office. 1998. *Information Technology: Assessment of the Department of Commerce’s Report on Workforce Demand and Supply*. March 20, Report No. B-278899, GAO/HEHS-98-106R, Information Technology Workers. Washington, D.C.