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Divider Title: E

Changes in H-1B Demand and Wage Offers, 1992-1998: Department of Labor Petitions Data

Research in Progress

This research uses Department of Labor Petitions data to examine wage offers for H-1Bs temporary workers, as well as legal permanent residents between 1992 and 1998. These data have not been evaluated by independent researchers for analytic purposes and this study will yield significant additional information. We know, for example, that wage increases in information technology have moderated in the past two to three years (Urban Institute). This moderation should be reflected in the wage offers that employers attest they will pay to prospective foreign workers.

If the change and levels of wages offers for foreign workers exceed national averages, or the wages of other professionals within the Department of Labor data, it would suggest that there is a differential preference for foreign workers (demand exceeds the market average). If the change and levels of wage offers for foreign workers lags the national average, it would suggest that employers expect to pay foreign workers less than domestic workers.

Initial results of a preliminary analysis of the data are shown on the next page. The final analysis will be significantly more complex including month-to-month changes in wages for more detailed occupational groupings, internal comparison of wage changes across occupations, and comparison to national-level averages.²

² These data are aggregated across all petitions for all employers, e.g., the petition is the unit of analysis not the employer. At this point in time, it is not possible to separately identify individual employers in the database (although it is possible to do so with further research and programming). This means that the wages are weighted by repeated petitioning by a subset of employers.

Specialty H-1B Worker Labor Condition Attestations and Average Yearly Salary and Number of Petitions

Occupational Category	Average Wage			Petitions		
	1992	1997	1997 / 1992	1992	1997	1997 / 1992
Architecture, Engineering and Surveying	\$42,188	\$49,643	1.18	4,520	18,279	4.04
Mathematics and Physical Sciences	\$40,217	\$46,189	1.15	2,093	3,178	1.52
Computer-related Occupations	\$39,750	\$49,178	1.24	5,732	63,468	11.07
Life Sciences	\$33,673	\$35,678	1.06	2,120	3,482	1.64
Social Sciences	\$42,449	\$42,826	1.01	808	3,153	3.90
Medicine and Health	\$43,891	\$55,903	1.27	4,114	12,569	3.06
Education	\$33,945	\$36,302	1.07	4,878	8,226	1.69
Museum, Library, and Archival Sciences	\$29,309	\$36,562	1.25	98	255	2.60
Law and Jurisprudence	\$64,605	\$67,499	1.04	342	818	2.39
Religion and Theology	\$25,980	\$32,090	1.24	50	77	1.54
Writing	\$37,212	\$37,613	1.01	235	1,092	4.65
Art	\$35,479	\$39,535	1.11	336	1,876	5.58
Entertainment and Recreation	\$37,953	\$39,637	1.04	135	348	2.58
Administrative Occupations	\$38,514	\$42,508	1.10	2,132	11,225	5.27
Managers and Officials	\$62,706	\$59,072	0.94	1,919	6,613	3.45
Professional, Technical, and Managerial	\$49,910	\$52,563	1.05	895	3,741	4.18
Fashion Models	\$134,583	\$115,000	0.85	4	11	2.75
Total	\$41,244	\$48,390	1.17	30,411	138,411	4.55

Source: Special tabulations by the author using Department of Labor, Administrative Data 1992, 1997.

Note: Data are for full time work, yearly salary reported, and approved cases in each database year.

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Divider Title: F

DRAFT

Contingent Work Among Immigrants in Information Technology: An Analysis with the Current Population Survey

Preliminary Results: Not for Citation or Circulation

October 1999

by

B. Lindsay Lowell and Edward Taylor¹

Critics argue that immigrants, especially temporary immigrants such as H-1B specialty workers, expect less and earn less than their domestic counterparts in information technology. There a number of reasons why that might be the case, however, one prevailing thought is that immigrants are hired in companies that out contract on short-term jobs. These are often what are referred to as "job shops."

This research uses special supplements on "contingent workers" in the Current Population Survey (CPS) of 1995 and 1997. Contingent workers are defined most broadly in the CPS as individuals in temporary jobs, e.g., work that is not expected to be permanent. If immigrants are disproportionately likely to be contingent workers this would imply that, indeed, they are more likely to be employed in a segment of information technology jobs that are less desirable. We use occupation classifications that confine the analysis to a broad set of information technology jobs.

Importantly, we operationalize the foreign-born workforce by year of entry. "Recent immigrants" are those who have arrived in the past five years—it is quite possible that a significant proportion of these immigrants are so-called temporary (nonimmigrant visa or NIV) workers. In the final report we will show estimates that substantiate this expectation.

The Likelihood of Contingent Employment

What we have learned, thus far, is that recent immigrants are much more likely to be contingent workers than are native-born IT workers. As the table below shows, they are nearly three times as likely to be contingent workers than their native-born counterparts. These results control for human capital characteristics such as education and experience, as well as, marital status. In

¹ Professor Taylor is a labor economist at the University of California at Davis and is a consultant on the project.

other words, we can be fairly confident that recent immigrants are indeed much more likely to be in contingent jobs.

In fact, the results are statistically significant only for the recent immigrants. Immigrants who have been in the country for more than five years are not significantly more likely than natives to be in contingent work. Contingent status is confined to only more recent immigrants. A noncitizen who entered the US between 1994 and 1997, other things being equal, had an 18.2-percent estimated probability of being in a contingent status—twice the propensity of those entering at the start of the 1990s (1990-1993; 9.4 percent). Noncitizens entering the US prior to the 1990s had a propensity of being in a contingent employment status that was similar to that of citizens (5.8 percent, compared with 5.2 percent for citizens).

Estimated Probabilities of Contingent Work Status, By Immigration Status and Period of Entry into U.S., Current Population Survey 1997.

Noncitizens	Probability of Contingent Work Status
Period of Entry	
1994-97	0.182
1990-93	0.094
Pre-1990	0.058
Citizens	0.052

Earnings Given Contingent Status

While this appears to be similar to an "assimilation" process, we take one more step and look at the effect on earnings. That is, we expect immigrants to learn rapidly and to achieve labor market outcomes at least as good as natives over time. Ten to fifteen years is the usual period of time that it takes to achieve earnings assimilation; and these results suggest that contingent status is confined more narrowly to the first five years (regression using pooled 1996 and 1997 CPS). This period of time also corresponds to the duration of stay of most temporary workers, e.g., the permitted stay for H-1B specialty workers is no more than six years.

What do we expect that the implications are for immigrant earnings. First, by taking the average person in the full CPS sample (that is, with characteristics averaged over all observations) and estimating his/her expected earnings first as a contingent worker and then as a noncontingent worker, we can net out these human capital effects on earnings. The result is:

Expected Weekly Earnings for a Person with the Average Characteristics in the CPS S&E Sample, by Employment Status

<u>Contingent</u>	<u>NonContingent</u>	<u>% Difference</u>
\$229.07	\$552.27	141.10%

*Evaluated at the full-sample (N=4,999) mean of all other explanatory variables in earnings regressions

We then take the next step and calculate the expected earnings of recent immigrants in information technology. These foreign workers are substantially more likely to be contingent workers and we know also that contingent workers earn much less on average than non-contingent workers.

In short, our initial findings are:

- Recent immigrants in information technology occupations are significantly more likely to be in a unwanted contingent status than other (earlier entrants and native) workers, and
- Information technology workers who find themselves in this contingent status earn significantly less than they would earn if they were not in a contingent status.
- The expected earnings of recent immigrants are substantially below that of other workers. Their contingent status appears to be the major explanation of this earnings differential.
- Whereas the wages of non-contingent information technology workers has increased from 1995 onward, the wages of the contingent IT workforce have been stagnant.

PROBIT REGRESSION FOR THE LIKELIHOOD OF CONTINGENT EMPLOYMENT

VARIABLE NAME	ESTIMATED COEFFICIENT	STANDARD ERROR	T-RATIO	ELASTICITY AT MEANS	AGGREGATE ELASTICITY
YEAR	-0.19973E-01	0.57586E-01	-0.34683	-0.19417E-01	-0.16005E-01
EXP	-0.57186E-01	0.12104E-01	-4.7246	-3.5958	-2.9080
EXPSQ	0.77966E-03	0.17112E-03	4.5561	1.7140	1.3838
D0TO5	0.65446	0.17165	3.8128	0.20618E-01	0.38989E-01
D6TO10	-0.17780	0.21011	-0.84622	-0.91201E-02	-0.54938E-02
D11TO15	-0.13331E-01	0.24401	-0.54632E-01	-0.40920E-03	-0.31332E-03
SEX	-0.85093E-01	0.61309E-01	-1.3879	-0.11950	-0.93931E-01
ED	-0.32115E-01	0.14684E-01	-2.1872	-0.13704	-0.10365
MARST	-0.19910	0.62145E-01	-3.2039	-0.25605	-0.17847
CONSTANT	-0.40413	0.19538	-2.0684	-0.81597	-0.68503

LOG-LIKELIHOOD FUNCTION = -1099.4

LOG-LIKELIHOOD(0) = -1134.8

LIKELIHOOD RATIO TEST = 70.7009 WITH 9 D.F.

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DRAFT

ABSTRACT

Characteristics of Employers of Foreign Temporary Workers: A Systematic Profile of the Employers of Specialty Worker H-1Bs

March 31, 2000

by

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In 1998, the INS provided two lists of U.S. companies ranked according to the number of petitions (H-1B workers) made by each: the "Top 20" list and the "Top 100" list.¹ Most of this analysis is based on data obtained from Dun and Bradstreet's (D&B) U.S. Marketing Lists program for companies on the Top 100 List. Although there are several cross-overs between the two lists, those companies appearing on the Top 20 List but not the Top 100 List have been added, provided there was a corresponding record in the Dunn and Bradstreet database. The goal has; therefore, been inclusion of as many companies on both lists as possible, as well as the inclusion of one and only one D&B record for each company on the INS lists. The result is a sample of 80 company records that refers to 71 individual companies.

In brief, we find that these "top users" of H-1Bs are not typical of the U.S. economy or the information technology industry in particular.

- 80 % of these top users are in the information technology industries
 - top users are large companies, compared to the average, small IT company
 - they have many employees
 - they have a large volume of annual sales
 - top users are found disproportionately on the east coast, compared to the average IT company that is found in California, Texas, or New York
 - over one-fifth are located in New Jersey
 - over one-tenth are located in Massachusetts
 - top users are predominantly dominated by a single ethnicity, compared to the average IT company that draws primarily on European, as well as Asian surnamed CEOs and top management.
 - nearly two-thirds of CEOs have South Asian surnames

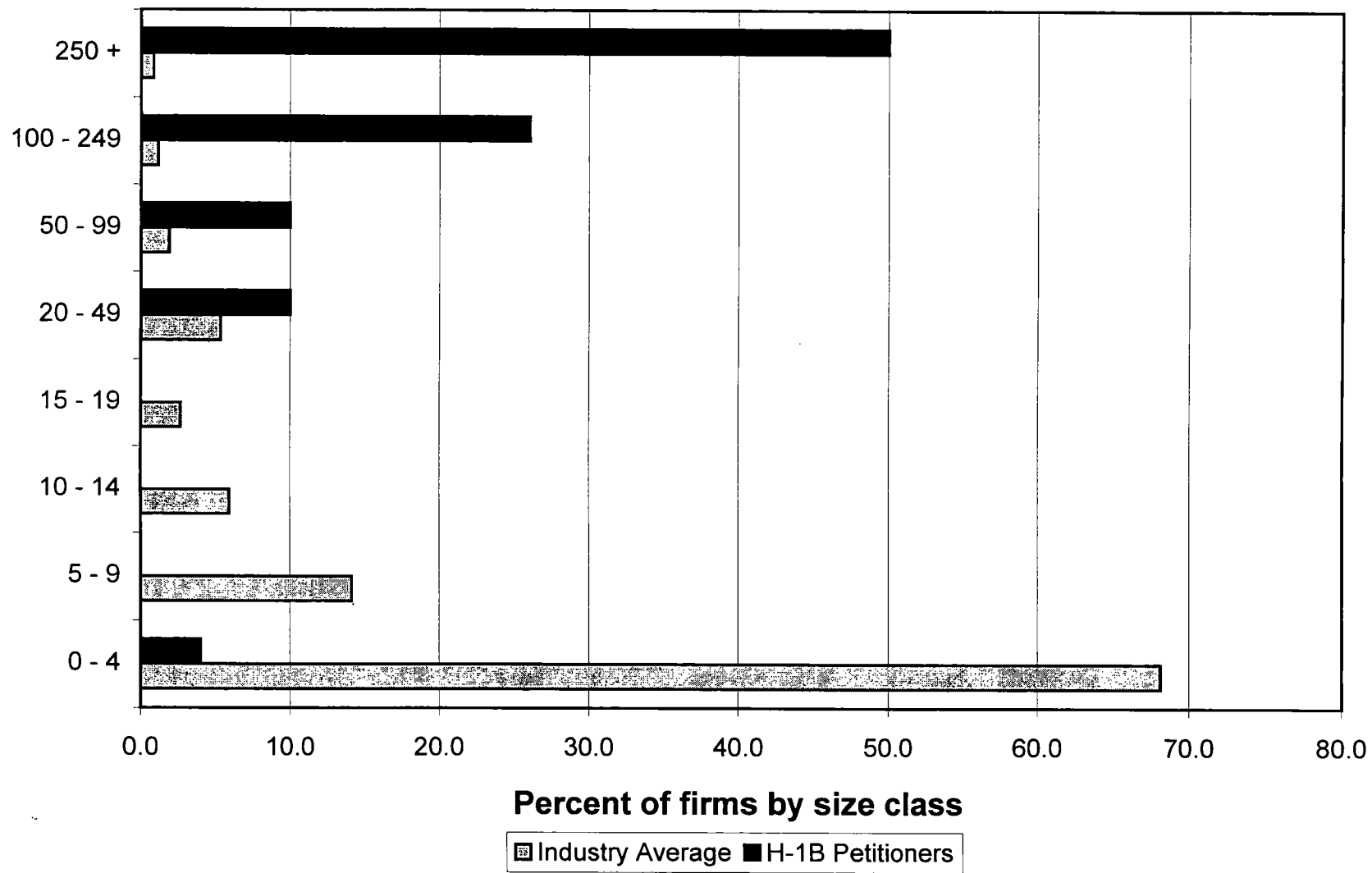
¹ The top 100 industries time slot and approved, the top 20 time slot and not nec granted.

TABLE 2: COMPANY CHARACTERISTICS BY ETHNICITY OF CEOs

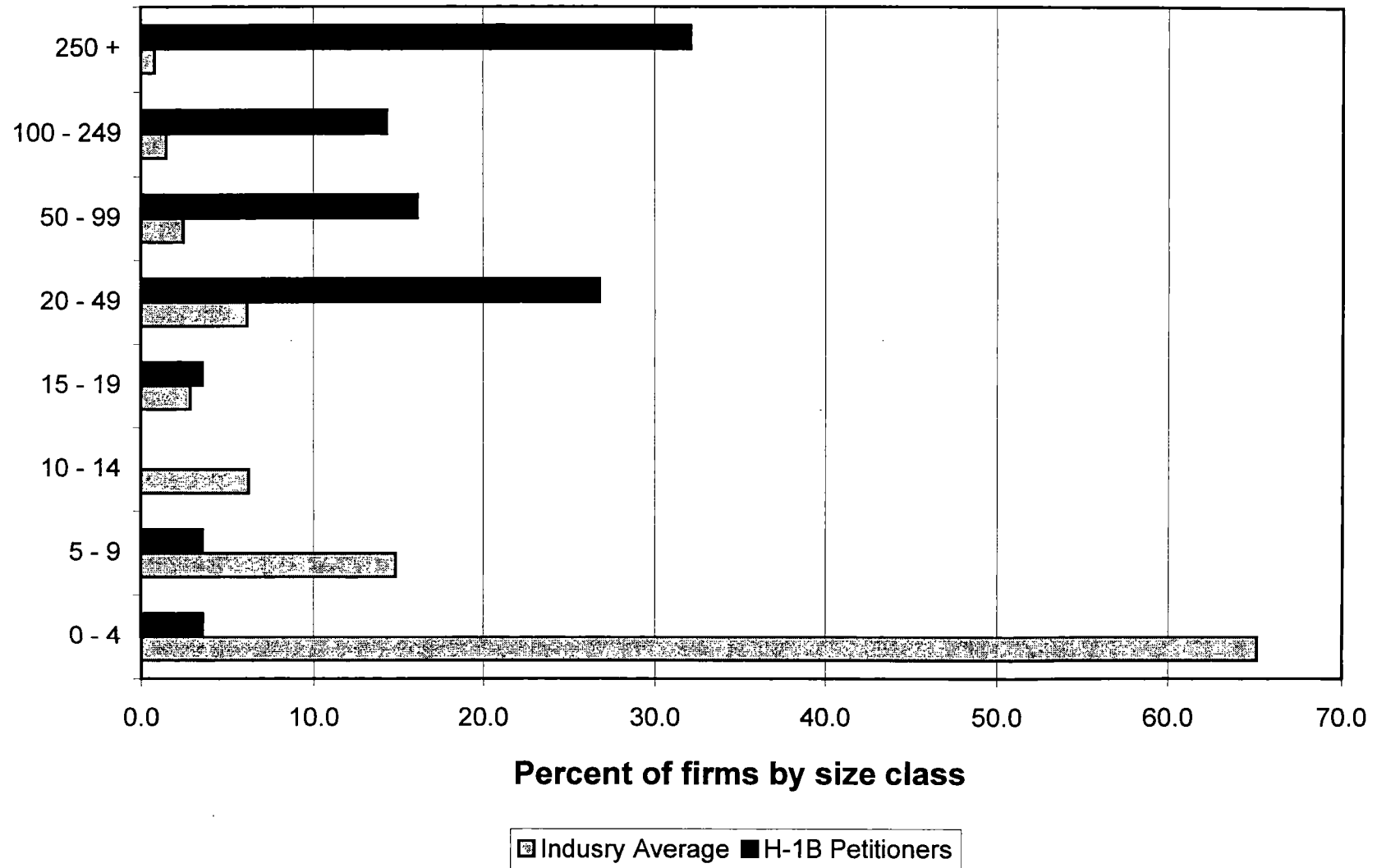
	All	South Asian	Other
BREAKDOWN			
Number of companies	71	42	27
Percent	100.0	59.2	40.8
INDUSTRIES REPRESENTED			
Number of 4-digit SIC Codes	18	9	14
COMPANY SIZE			
Median Employees on Location	80	70	105
Range	5,697	1,822	5,697
Median Total Employees	228	225	300
Range	132,997	5,497	132,997
Median Sales (Millions)	\$23.8	\$20.7	\$89.9
Range	\$29,400.0	\$232.0	\$29,400.0
LONGEVITY			
Median Years in Business	7	7	11
Range	70	26	70
PERCENT DISTRIBUTION BY STATE			
California (Percent of Total)	23.9	19.0	29.6
New Jersey	19.7	14.3	25.9
Massachusetts	9.9	11.9	7.4
Pennsylvania	8.5	11.9	3.7
New York	7.0	4.8	11.1
Michigan	5.6	9.5	0.0
Virginia	5.6	7.1	3.7
Top Seven Cumulative	80.2	78.5	81.4
PERCENT INFORMATION TECHNOLOGY (IT)			
IT	80.3	88.1	66.7
Non-IT	19.7	11.9	33.3

INS "TOP H1B" users

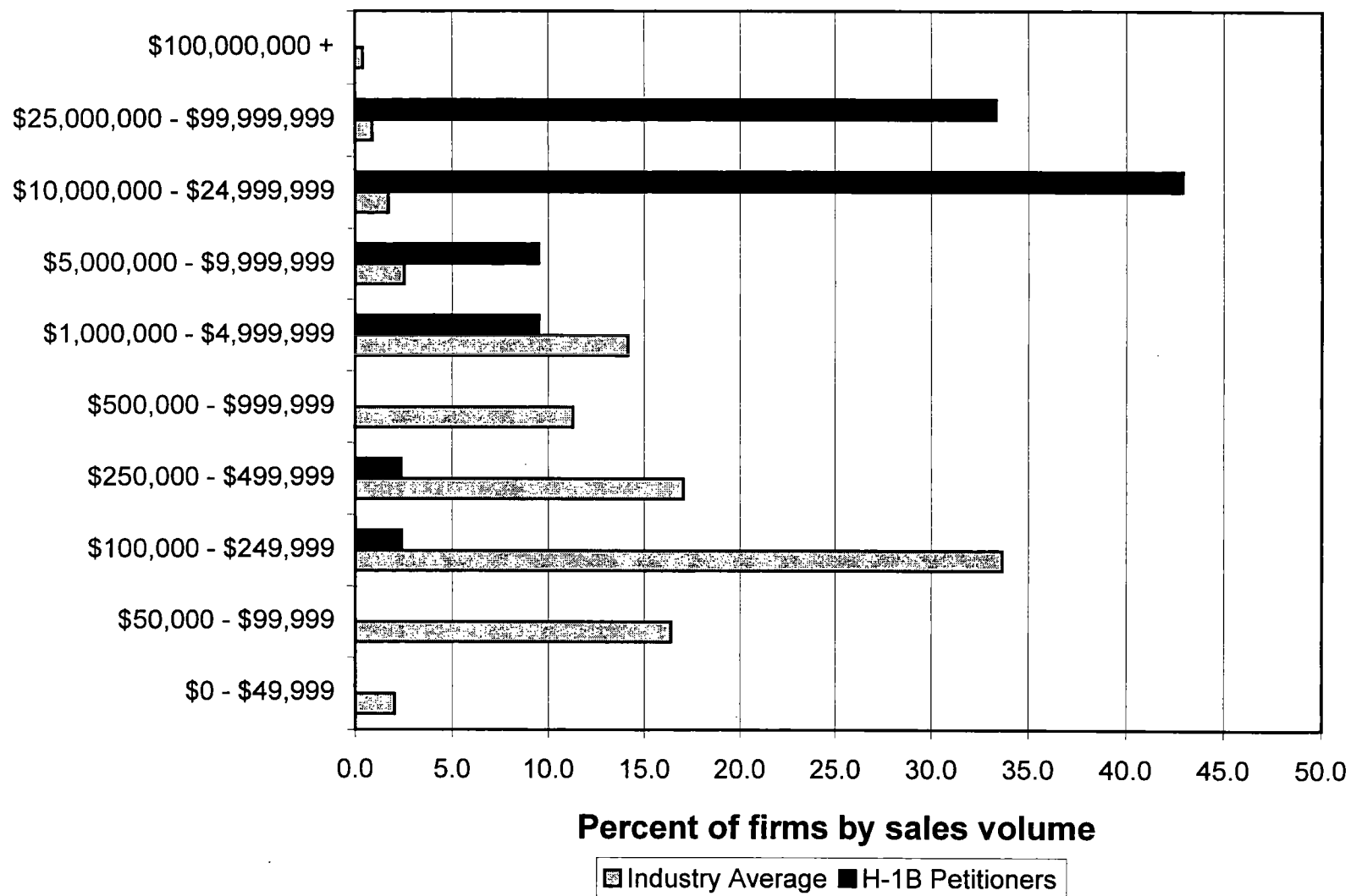
Total Employees (IT companies only)



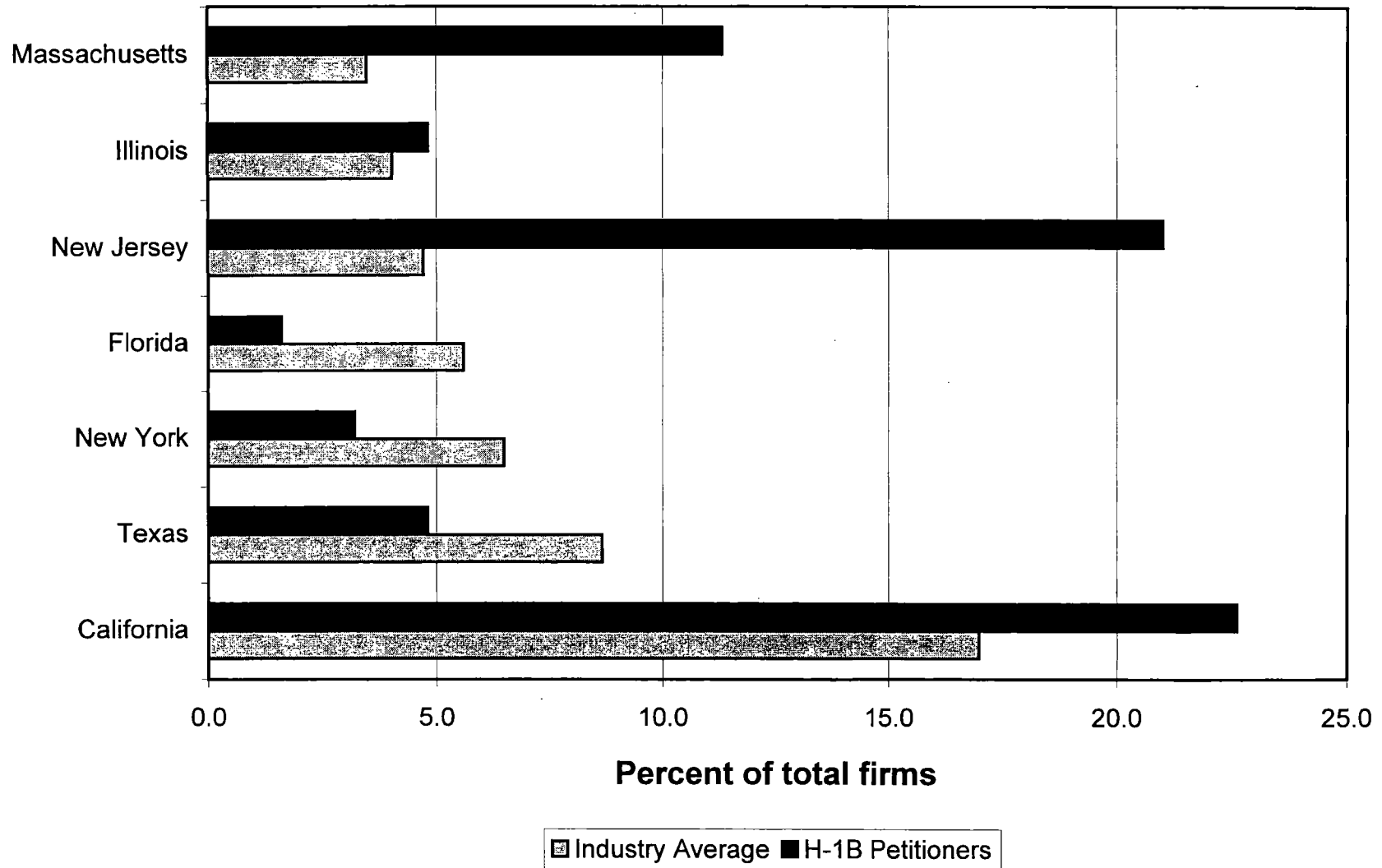
Employees on Location (IT companies only)



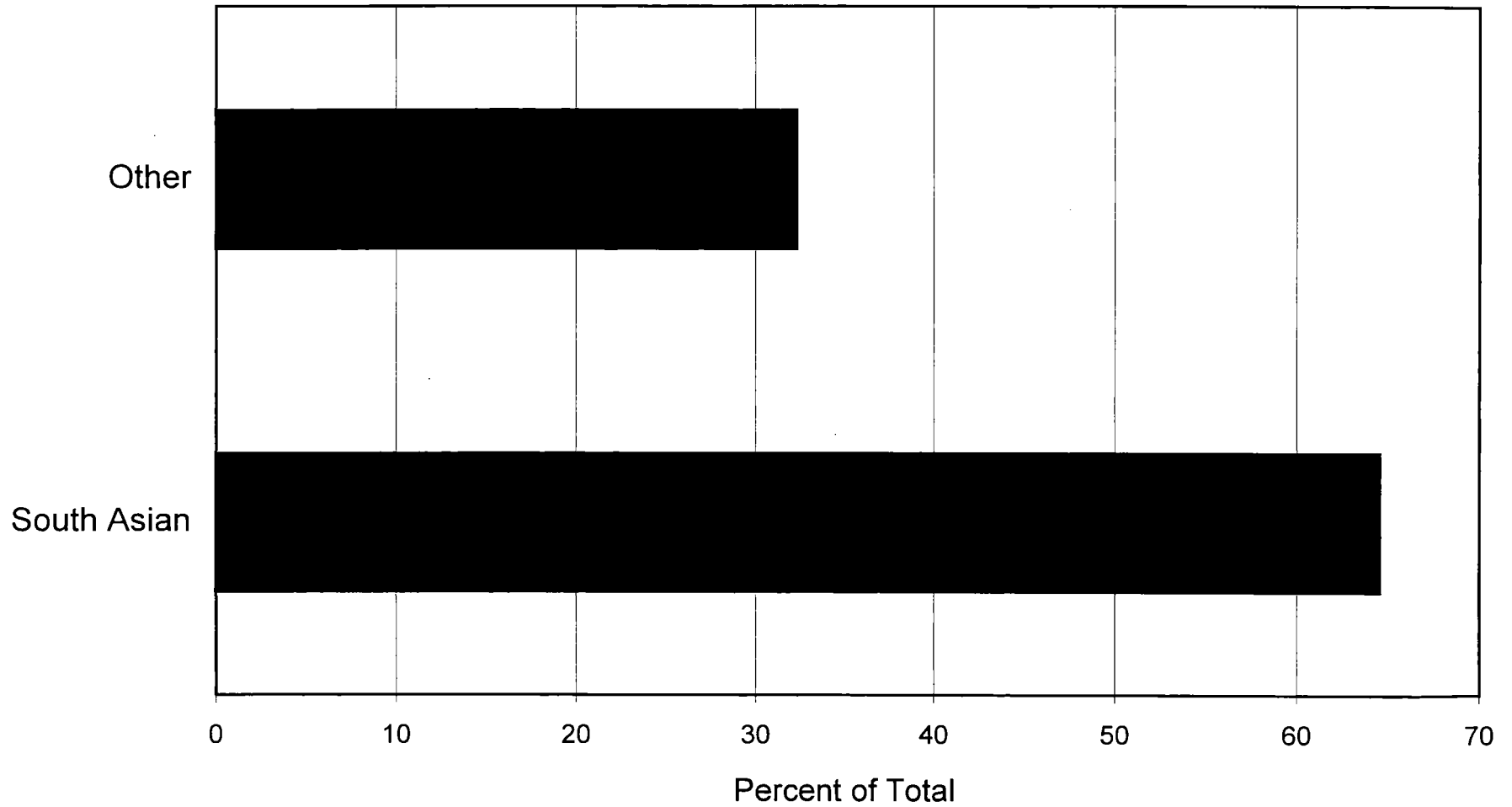
Annual Sales Volume 1999 (IT companies only)



Geographic Concentration (IT companies only)



Ethnicities of CEOs of H-1B Petitioners (IT Only)



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Divider Title: H

**INFORMATION TECHNOLOGY COMPANIES AND
U.S. IMMIGRATION POLICY: HIRING FOREIGN WORKERS**

March 2000

by

B. Lindsay Lowell

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ABSTRACT

Employers are at the heart of immigration policy for work-authorized visas, and information technology (IT) companies are at the center of today's policy debates. This paper discusses employer perceptions drawing upon the results of a small nonrandom survey of IT companies, as well as two workshops and field interviews of IT employers. These employers, who have extensive experience with the immigration system, typically report that they hire the most qualified workers, regardless of nativity. Although all utilize nonimmigrant visas, only a minority of employers report that their most important reason for hiring foreign workers is to fill temporary rather than permanent positions. They also report a substantial turnover of foreign workers following adjustment to permanent residency. Though frustrated with current immigration policies and procedures, employers overwhelmingly opt for reforming the current system rather than scrapping it. Most notably, employers consider streamlining of the labor certification and adjustment process to be the most important procedural reforms needed.

INFORMATION TECHNOLOGY COMPANIES AND U.S. IMMIGRATION POLICY: HIRING FOREIGN WORKERS

Significant numbers of immigrants are admitted into the United States authorized to work on a temporary basis, or as legal permanent residents (green card) under the employment-based admissions system. Employers, as sponsors of both temporary and permanent resident workers, are at the heart of U.S. immigration policy on skilled workers from abroad. Indeed, it is only the work-authorized component of the immigrant admission system where skills account. But it is the employers who drive the system. A well-run system that is in the national interest must be efficient, meeting employers legitimate human resource needs, while protecting domestic labor.

Where the preponderance of available research on the U.S. immigration system focuses on immigrants themselves, this report turns this around and asks questions of employers. The focus is on the information technology sector that is the fastest growing sector and leading edge of today's economy. We draw upon interviews with employers in the field, discussions with employers in workshops, and a small survey of employers. We have an interest in the hiring behavior of employers, the reasons they hire foreign workers, and general sentiments about how to improve the current procedures for hiring foreign workers.

This report profiles the findings of the targeted survey, looking at the hiring experiences of a set of companies with extensive background in the employment of both temporary and permanent immigrants. In no way are the results of the survey a "representative sampling" of the broader information technology industry. Rather, the deep experience of these select companies with immigration policy makes them ideal informants. There are 13 companies in the survey who are members of the Information Technology Association of America (ITAA).¹ The Institute for the Study of International Migration

¹ Most of the ITAA companies surveyed are part of the IT Services Division Immigration Policy Subcommittee.

(ISIM) developed the questionnaire with valuable feedback from the ITAA. The companies were contacted by the ITAA with a cover letter encouraging their open and confidential participation.

We combine here what we learn from the survey respondents with what we have learned from employers in other forums. The staff of the ISIM have over half a dozen years of experience talking with employers in a variety of venues, both in individual discussions and in discussion groups. For this project, the Institute had two day long meetings with representatives from the IT sector and other industries that employ high skill workers (ISIM 1999a, 1999b). Employers' experience in today's labor market and their reactions to current and prospective policies formed the core of these discussions. A small number of companies identified from government records as having sought hiring approval, were visited and engaged in open-ended conversation.² A certain commonality of themes has appeared over the course of these discussions that we draw upon to elaborate what we have learned in the survey.

THE SURVEY COMPANIES SPONSORSHIP OF WORKING VISAS

We asked the companies whether they had ever hired any of the classes of work authorized temporary labor, as well as, three employment-based permanent work visas. Figure 1 shows that they have extensive experience with all classes of temporary and permanent visas. In the temporary categories, the H-1B specialty worker visa class has received the most attention among policymakers in the past few years. The specialty worker was created in the Immigration Act of 1990 and implemented in 1992. The H-1B permits a three-year stay that can be extended for an additional three years for a total of six years. All of the surveyed companies report having hired an H-1B worker. Four companies reported that they would qualify as H-1b dependent businesses (see appendix

² We interviewed four companies in the field, along with several workers and a small group of students. Less structured interviews were conducted over the phone and with individual company representatives at the two meetings. We originally thought to interview a larger number of companies, but like other researchers looking at IT companies and immigrants, "in the field, however, we were refused interviews by a number of the employers. Still others blocked access to their employees and their attorneys (Hagan and McCollom 1999:153)." We did not encounter hostility or defensiveness, rather most contacts were extremely busy and/or profoundly disinterested.

for definition and discussion).

The TN or “trade NAFTA” visa is of recent origin having been implemented following the implementation of the North American free trade agreement in 1994. These TN visas are, at this point in time, almost all used by Canadian workers with skills and education similar to the H-1B. The TN visa is for one year but can be renewed indefinitely. About nine in ten of the companies report having experience with the TN visa.

A similar proportion report experience with the F foreign student visa. In almost all cases this experience is likely to have been for the one year of “practical training” permitted under the F visa. In practice many foreign students will become H-1B specialty workers with the same or another company following their year of practical training is completed.

Only about two-thirds of these companies have experience with L intracompany transferees. This visa is for companies with international personnel that wish to transfer non-U.S. workers to their U.S. location. The L visa permits a duration of stay for work of no more than five years. While we do not know the international make-up of these surveyed companies, many obviously have a need for temporary intracompany transferees of their international personnel.

There are three classes of interest in the permanent employment-based classes of admission. As Figure 1 shows, there is a major distinction between the EB1 extraordinary ability visa, and the EB2 advanced degree and EB3 skilled worker visa. The EB1 extraordinary ability visa does not require an employer certification by the U.S. Department of Labor; however, it does require an advanced degree and proof of superior qualifications. The extraordinary ability visa is also tailored for the adjustment of temporary L intracompany transferees. Less than one-fifth of these companies report having ever hired an EB1 visaholder.

In contrast, they have extensive experience with both the EB2 advanced degree and EB3 skilled worker visas that require a Department of Labor certification prior to the hiring of

the permanent foreign worker. All of these companies report having hired an EB3 and over eight-tenths of them report having hired an EB2. Given that all have hired temporary H-1Bs, who are the major source of adjusters to the EB3 and the EB2, it no surprise that these permanent visas are common.

Indeed, what we see is a uniform use among all these companies of the H-1B specialty worker and the permanent EB3 skilled worker visa. While we cannot track to what degree it is occurring, these patterns suggest that these companies hire many H-1Bs who later adjust to permanent residence status, a typical progression fostered by immigration policy. If we were able to track individuals within these companies we also suspect that we would see transitions for many foreign students to the H-1B and, subsequently, to the EB2 and EB3 permanent visas (although not necessarily within the same firm). Although these data do not allow us to view such progressions, they are likely.

COMPANY SIZE AND THE IT WORKFORCE

As Figure 2 shows, the median size of these companies is a little over 3,500; while the range runs from the smallest at 200 workers to the largest with well over 100,000.³ About two-thirds of their total company workforce is made up of information technology workers, an occupational classification describing the nature of their work. The remaining third of the median workforce, clearly, work in non-IT occupations that are likely in marketing, administrative, and support roles.

We asked the companies about the number of IT foreign workers whom they had sponsored, e.g., just those foreign-born workers they had actively hired through the legal immigration system. About one-seventh of these companies overall or total labor force is made up of sponsored foreign workers, while about one-quarter of just the IT workforce within these companies are sponsored IT foreign workers. Estimates of the national IT labor force, made by the ISIM from the Bureau of Labor Statistics' Current Population

Survey, indicate that one-seventh of all IT workers nationwide are foreign born. Hence, the proportion of these companies' labor force that is foreign-born is somewhat greater than the national average.

Next, we asked the companies questions about their workforce to give us a rough idea about the size and the turnover in temporary and permanent visaholders. We asked how many information technology workers they had sponsored since 1994, or over the past five years. This period of time would be less than the six-year maximum state permitted, for example, for the H-1B specialty worker. We then asked how many temporary and permanent workers they employ today. However, we do not ask whether or not their current foreign-born employees are the same ones they had sponsored over the past five years. This means we can only get an approximate idea of turnover among temporary and permanent foreign-born employees.

Nevertheless, there are distinct differences in the pool of temporary and permanent visaholders. These companies have hired a little over 600 (median) temporary workers in the past five years, once again demonstrating the unique experience these companies have with the immigration system. Currently, they employ a median number of temporary visaholders somewhere in the neighborhood of just under 600 workers. The figures suggest that about nine in ten temporary workers stay on; yet, this would be an incorrect inference for we do not know if the workers currently employed were sponsored within the five-year window.

What this does indicate is that the companies are able to maintain their pool of temporary workers, either because original hires stay on for their permitted duration of stay, or because they are more easily able to replenish this pool of workers. Replenishment would be the case, for example, with F foreign students who typically are "sponsored" for

³ Medians are preferred over the arithmetic mean for such a small sample. Because we are reporting medians, and because the companies do not report each category of their workforce with equal precision, not all subtotals will sum precisely.

no more than one year of practical training.⁴ On the other hand we can infer, especially for L-1s and H-1Bs, that temporary visaholders remain with the companies during their entire permitted duration of stay.

In contrast and consistent with what we have heard from employers for many years, far fewer sponsored permanent workers stay on with the company that originally sponsored them. The temporary visa is linked to the sponsoring employer and the temporary worker may not, except in unusual circumstances, seek employment with a different employer. Of course, foreign-born workers who have adjusted to legal and permanent residency are free to seek employment in the open labor market. As one respondent told us,

“Usually the green card means freedom to a foreign employee. They usually leave. But since they have worked during the entire process, at least three years, their leaving coincides with the natural rate of attrition in this industry.”

Thus, these companies report that their current workforce of permanent visa holders is only about one-quarter the size of permanent workers sponsored over the past five years, suggesting that as many as three-quarters may leave within five years after adjusting. This reflects a common observation among employers especially in information technology industries, as well as, many other highly skilled sectors. One exception we heard came from a small company that almost uniformly hired foreign workers with Ph.D.s and experienced little turnover, suggesting that turnover may vary by worker education and the nature of a company’s service or product (especially more basic research and development). Nevertheless, permanent status typically means freedom to seek better working conditions or higher wages, and it reflects the natural rate of turnover that occurs in rapidly growing industries.

⁴ Nonetheless, the “turnover” of F foreign student might not be all that great. Many F foreign students are sponsored, often by the same employer, to become H-1B specialty workers. This is quite typical and well within the parameters of immigration policy. This transition can be problematic if the number of available H-1Bs collapses as it has during the past three years. In talking with foreign students we heard of Fs whom had jobs lined up and who had been in the queue for H-1B status only to have the numbers run out. In

Again, while these are admittedly crude indicators of turnover, they closely mirror what we expect from our conversations with employers over the years. And of course, their figures are quite consistent with what we might expect given U.S. immigration policy and the different constraints placed on the foreign worker in the temporary and permanent systems. According to a recent study by the American Council on International Personnel, Inc., more than half of all U.S. corporations surveyed had dedicated resources to international, intra-company personnel transfers. Skilled migration resulting from such exchanges tends to be almost exclusively temporary, lasting between six months and six years, and related to specific company projects.⁵ One employer we talked to was proud that he treated his employees exceptionally well and that his turnover rate was no more than “five or six percent compared with an industry average of 30 percent.” Holding on to experienced workers is preferable, but the industry appears to militate against it and permanent resident status permits foreign-born workers to behave just as their domestic counterparts in translating their skills into better working conditions.

WHY EMPLOYERS HIRE FOREIGN WORKERS

When talking to employers in information technology industry, in particular, we consistently hear that they seek the best and brightest workers. This is a sector that requires workers with specialized knowledge and skills. No doubt, employers everywhere want to hire the best workers and information technology is no different; but there may be several reasons for wanting to hire foreign workers in particular. We listed six reasons that employers give for hiring foreign workers and asked them to rank each in importance on a scale from one (least important) to five (most important).

some cases the employer lost the worker and the sunk costs in finding (training) them, in other cases the foreign student stayed on in illegal status hoping the situation would turn around in the next cycle.

⁵ In addition to forming a bulwark against labor-market shortages, high skilled migration has been held up as a way for companies to acquire the best workers. Sponsoring highly skilled foreign workers, which in the United States can include legal fees totaling \$5,000-\$10,000 for a non-immigrant visa, is an economic decision by corporations. Since it is less expensive to hire a domestic worker, the businesses would not recruit foreign workers unless they were truly needed.

The list did not include certain reasons offered by critics, such that foreign workers will work at lower wages, that we did not expect employers to acknowledge. Critics charge that immigrants, who come from countries with lower wages, are willing to work for less or to work harder than domestic workers—and that employers hire them with that in mind (Matloff 1999). However, employers report that they do not pay immigrants less and they give good reasons for why they cannot. Indeed, in the field employers denied paying foreign workers any less because. As one employer told us, even though he “would like to pay less” in order to compensate the company for the time it takes foreign workers to learn English and the job, the law does not permit them to pay less and demand is too great to enable them to do so.

Figure 3 shows the proportion of respondents who felt that the given reason is the most important (5 on the scale). Consistent with public pronouncements on the reasons businesses hire foreign workers, a large majority of employers cited employee qualifications in explaining their hiring practices. Two-thirds of these employers reported that the most important reason for hiring foreign workers is that they are the “best qualified” for the job. In fact, 100 percent or all of these respondents ranked most qualified as numbers four or five on the scale of importance for why they hire foreign workers. As one employer reported to us:

We are always recruiting and hiring. We look for the people with the best skills both soft skills and technical skills, whether they are US citizens or foreign nationals.

One employer echoed a frequently heard expression in telling us “foreign hires are the last option to recruiters” and he preferred to hire domestic workers. After all, another employer pointed out foreign workers often incur start up costs that natives do not—they need to learn “how to wash, come to work on time, drive in the left” and the basics of “U.S. work culture.” We heard that language skills are sometimes a problem and that, in a few cases, the foreign workers are pooled in the “tech jobs” and domestic workers do

the administration and interact with the customers.⁶ However, employers consistently report that, despite large number of applications from newspaper ads, etc., the number of truly qualified persons are few and foreign workers sometimes have an edge in skills that makes them more qualified for specific job needs.

Indeed, following qualifications in terms of most important reason (5 on the scale), are skills in computer and electronic “software” or “hardware.” The software skills of foreign workers are more important to these companies than are hardware skills: nearly one-half ranked software skills as most important compared with about one-third who ranked hardware skills as most important. These are precisely the skills we would expect employers in information technology to seek in their workers. The fact that software skills are more important than hardware skills no doubt reflects the greater preponderance of jobs in programming. While this is not surprising, it is interesting that these specialized skill sets supersede, among these respondents, hiring motivations based upon more non-skill based reasons. And, of course, the smaller companies we talked with did not have regular training programs; rather they focused on hiring people with just the right skill sets. They argued that training was too time consuming and costly given the short-turn around required by most contracts, as well as, the frequently high turnover of both natives and domestic workers in the industry.⁷

In fact at the other extreme, not a single respondent thought that “very good work habits” was the most important reason for hiring foreign workers. This contrast highlights employers' focus on skills sets, rather than on the putative hard working ethic of foreign-born workers. As we will see in the next item, while the surveyed employers state what may well be prevailing sentiment in the industry, there are ready instances of companies

⁶ Two employers told us that such costs were sufficient to make them want to “pay less” to foreign workers, but both the law and the competition in the labor market meant they “had to” pay foreign workers the same as natives.

⁷ One employer told us that the average of a software program is “life cycle of six months or so” and that, after retraining, workers often parlayed the new skills into a job elsewhere. Training can have its downside. We talked to one small employer who had high hopes on a planned four-month training course in network management for high school graduates based on an Indian model. We also talked to an employer who had run an advanced skills on-the-job training program for two years, but who stopped it because his retrained employees literally took their skills to another company across the street.

that find some advantages in foreign “work habits.” For example, one employer told us that his foreign employees happily worked in the small “boring” southern towns where he had contracts with a major airline. Others found that young, unmarried foreign employees had more time for the job and were less likely to leave the company.⁸ Still, among the surveyed companies two-thirds reported that work habits are the least important (3 or less on the scale) of all the reasons for hiring given in the questionnaire.

Interestingly, given what we know about immigrants generally, only one in five respondents report their “ready availability by referral” (job networks) as the most important reason for hiring them. Because of the nature of the nonrandom nature of the company sample, we do not know to what extent this is characteristic of IT companies. It may well be that the hiring of immigrants through referral is not as common as it is in low-skill industries.⁹ However, we do know that network hiring occurs because our field respondents reported that the high cost of headhunters and other search techniques made referral a valuable method of finding workers. A small firm of 75 employees reported running up headhunter costs of \$250,000 over a two-year period. Even within the sample, the smaller companies in our survey were more likely than the larger companies to report ease of hiring through referrals as an important reason for hiring foreign workers. Smaller companies were also more likely to report “work habits” as an important reason for hiring foreign workers.

Still, in talking to small companies with many foreign workers we did not detect any obvious adverse working conditions for either foreign or native workers. In fact, all the employers we talked with stressed significant wage growth in the industry and intense competition. The figures employers quoted ran much higher than the 3 to 5 percent IT wage growth represented in national statistics (Barnow et al. 1998)—at the extreme one

⁸ The variety of employer experiences is fascinating. One employer, for example, told us that he found that many of his foreign workers came from “better-off” families and demanded wages and conditions that they did not qualify for. As stated in the text, nevertheless, a systematic survey suggests that such experiences are not prevalent among IT companies.

⁹ Employers in other, particularly low skill industries often report hiring foreign workers because they are easy to get through networks. Research in such industries indicates that hiring on this basis can crowd out domestic workers not on the inside of the strong immigrant networks (Waldinger and Bozorgmehr 1996).

specialized medical-applications software company claimed 50 percent wage growth year-to-year over the past three years. Yet, over and over again we heard that it was difficult to find appropriately qualified workers to meet their job needs. When companies are doubling in size every half-year or so, finding locally available labor to meet rather specific contracted job requirements on extremely short notice can quite clearly be a problem. One employer facing such rapid growth told us the major reason he hired foreign workers was that they made up “70 to 80 percent” of job applicants.

Finally, perhaps one of the more interesting results is that only one in five of these respondents report the need to fill temporary positions as the most important reason for hiring foreign workers. Given the extensive hiring experience these companies have with temporary foreign workers, casual observers might find this a little inconsistent. Recall, nonetheless, that neither the H-1B specialty worker nor the L intracompany transferee need be temporary positions. The positions may be intended to be permanent by the employer. So to the extent that these visas dominate the pool of temporary workers, this is not inconsistent reporting on the part of employers. At any rate, while not a leading most important reason (5 on the scale) for hiring foreign workers, the need to fill temporary positions is important. Well over two-thirds of these respondents ranked the need to fill temporary positions at least four on the scale of importance.

Overall, these employers reported reasons for hiring foreign workers consistent with those the Institute has heard in our various meetings with employers. They seek the most qualified employees, particularly those with special skills in software programming and hardware development and maintenance. While it is not primary or most important, frequently they seek to fill temporary needs with foreign workers. When talking to employers, the common theme is that they would just as soon hire native workers, but foreign workers help them meet their demand for quickly hiring workers who already are trained and/or experienced in specific skill sets (software applications). Among the surveyed employers, few report that they hire foreign workers because of superior work habits or because they are easier to find through referral or word-of-mouth job networks.

THE MOST IMPORTANT STEPS TO IMPROVED PROCEDURES

We listed ten possible steps that the government might take to simplify and improve the foreign worker approval process.¹⁰ The steps were ranked in the same manner as reasons for hiring just discussed, e.g., the respondents were asked to rank each in terms of its importance on a scale from one (least important) to five (most important). Survey respondents rankings are shown in Figure 4.

Just over two-thirds report that the most important way to improve the approval process and would be to speed employer certification for permanent workers. Next in order they believe that it is most important to speed the adjustment of temporary workers to permanent status. These strong responses on issues relating to current policies and regulations governing the permanent system are in line with what we heard in workshops and in-person interviews with employers, attorneys and government officials involved in these processes. They are also consistent with the above finding that employers are more likely to hire foreign workers because of their skills than because they are looking to fill temporary positions.

There is currently a 30-month wait for the Department of Labor to complete the certification of employers, enabling them to sponsor a foreign permanent worker. Additionally, employers must petition the INS prior to sponsoring a foreign worker that adds yet more time. For workers who are already in the United States, there is also a processing backlog for adjustment to permanent residence. In some INS districts, the adjustment process can take another two years. There is substantial variation in processing times across INS offices. For example, if you are an employer in Los Angeles seeking permanent resident status for an employee, the processing times are even longer. A regular labor certification takes up to 40 months to get through the state employment agency and the Department of Labor. Even an application that can be approved through an “expedited” process takes 12 months. Add the 10 months at INS for approval of the

¹⁰ The options focused on procedures not on numbers of foreign workers admitted under various categories.

petition and the 18-21 months for adjustment of status, and the whole expedited process can take 3 and one-half years, and five years if you must go through the regular process.

The employment process conflicts with these excessive lead times. The H-1B specialty workers may intend and do indeed often desire to stay in the United States for jobs that employers intend to be permanent. Obviously, the adjustment process is so lengthy that it can exceed the three-year duration of stay permitted a temporary H-1B specialty worker. Even if they receive a three-year extension, adjusting to permanent status within their permitted stay can be difficult. It is the case that both the temporary foreign worker and their prospective sponsoring employer for permanent status (often the same) must plan for the adjustment almost at the moment the temporary visa is given out. It is little wonder that employers are concerned about the time limits on the nonimmigrant visas for L intracompany transfers and H-1B specialty workers.

We have heard of cases where specialty workers who had been in queue for adjustment were suddenly caught in an awkward situation. Despite having planned in advance to adjust, their employer's labor certification and petition process was just coming to conclusion in the waning days of the permitted duration of stay. In some cases, the worker had to return home, leaving the job, until the certification and petitioning process is completed. Some employers and workers will simply give up on the adjustment and an experienced worker is lost (they fail to reenter as legal permanent residents). In yet other cases, the worker may opt to remain illegally in the country after their permitted temporary stay runs out, which could lead to ineligibility for adjustment and deportation. It goes without saying that the long lead time for certification and adjustment is burdensome for employers, does not meet their need for workers in a timely fashion, and generates significant human resource costs.

Although clearly frustrated by the slowness of the labor certification/adjustment process, employers gave less credence to options that would scrap labor certification altogether. Indeed less than half of these respondents thought that the much simpler attestation process used for temporary H-1B workers should "replace" the more cumbersome

certification required for permanent workers. And, only about one-quarter of the respondents thought that it would be a good idea to “scrap the current system and start all over again.” Not that employers’ desire to stay with the current system reflects confidence in the U.S. government, as one respondent noted:

Scrap the current system and start over! This suggestion would take and too long and considering the innovation [and] drive of the U.S. government further burden the current system. It could take years!

In our conversation with employers in various settings this aversion to large-scale changes in the system has been heard repeatedly. Employers familiar with government agencies find them bewilderingly slow and they distrust change as it threatens to gum up the already lengthy lead-time required to get workers. Indeed, this was the only recommendation which one-third of the companies identified as a least important action to take (one or two on the scale). None of the other recommended actions were deemed least important by more than a couple of companies in the survey.

Responding companies gave about equal support to a number of mechanisms that may work to streamline the process. Almost half of the responding companies identified the “improved training of government officials,” a reduction in “the number of steps required” in the visa approval process, and “computerizing of the entire process” as most important reforms to be undertaken. Only about one-third of the respondents thought that “involving business in setting standards,” or reducing “the number of government agencies” involved, are most important steps to improving the approval process. Less than one-quarter reported as most important the charge of a “small user fee for funding improvements.”

In other words, employers tend not to fault immigration policies *per se*, but rather the unnecessarily slow manner in which the process is carried out. This attitude on the part of employers is seen most clearly in their aversion to the idea of “scraping the current system and starting over.” The employers we talked to were frustrated with the lengthy

time it took to get things done and, oftentimes, expressed their lack of understanding with some of the steps required. And while a few employers termed the system bankrupt and desire a whole scale change, typically to a purely market-driven system with little to impede their access to labor, most are willing to comply with worker protections. Their greatest objections pure and simple are to the slowness, and the various costs that procedural slowness imposes, on their hiring.

H-1B SPECIALTY WORKERS: NUMBERS NOT PROCEDURES

Upon reflection, the ten reasons we provided the surveyed questions did not permit them to address recent “shortages” of H-1B workers—we refer here not to the debate over shortages of domestic workers, but rather to the fact that the number of H-1B visas issued has exceeded the cap early in the year in each of the past three years. Clearly, the greatest problem that employers have with procedures is, in fact, the extreme slowness in certifying and adjusting permanent foreign workers. This shows up clearly in the survey and is a consistent complaint heard by anyone who regularly talks with employers. In contrast, although employers find the attestation process “cumbersome,” the time lag for obtaining H-1B workers is measured in weeks, not months or years. Of course, many would simply like to “eliminate the cap on the number of H-1B workers.”

Yet, among the companies we talked to in the field, and those we heard from in our workshops, the recent problem of running into the cap early in the year created its own planning problems. One employer noted that an Indian programmer who had trained with the company as an F student, and was about ready to change status to become an H-1B, was inadmissible due to the cap running out in fiscal year 1997. They had planned for this individual to accomplish some key work, but instead had to send the student home for one month until the next fiscal year H-1B admission numbers became available. The employer calculated that the cost to his company of the lost month’s work was \$25,000. Another employer complained that they were caught unawares and were unable to bring in workers from Singapore whom they had planned to hire for a job. In short, while there are relatively speaking few complaints about the “procedures” required for

the admission of H-1B specialty workers, there is plentiful evidence of complaints about both (a) the number available, and (b) the inability to plan when unforecasted and last-minute stoppages in the availability of H-1Bs affects human resource planning.

CONCLUSIONS

This report is a systematic look at employers' use of immigrant workers in the information technology industry. Reiterating what was said at the outset of this paper, the discussion has not been of a random sample of information technology companies. Rather, it has built upon a small survey of immigrant-experienced companies to elucidate common themes that we have heard in field interviews with employers and in workshops with company representatives. It is systematic in that we consider a range of issues: the hiring experience of these companies, their workforce composition (see also appendix), their reasons for hiring foreign workers, and steps that they think are most important to improving the system.

No doubt, many employers would agree with one employer who told us that the "current laws are a farce, an administrative nightmare and totally ineffective." Employers are most distressed about the admissions procedures for the legal permanent system that they, quite rightly, see as burdensome and particularly slow. The waiting time for certification and adjustment is excessively long, reaching up to five years, and places significant constraints on the human resource strategies of companies. In the worse case scenarios, experienced workers are lost at substantial cost to employers and the national interest.

Employers tend to report that they would not scrap the system, instead they would simply make it more efficient. Most see streamlining the labor certification process as the most important reform needed. Among the surveyed companies, they recommend improved training of U.S. officials, computerizing the process, and reducing the steps needed to complete the approval process.

The question policymakers should entertain is whether or not it makes sense to continue with a system that frustrates employers needs, particularly since there is ample evidence that the current process fails in its other major purpose, to provide meaningful protections for domestic workers. No, there is no evidence of widespread adverse outcomes for domestic workers, but that appears to have little to do with results of immigration policy. Because of the long delays in adjudicating labor certifications and adjustments, employers generally use temporary visas to bridge the gap between application and final approval of the green card. In the meantime, to obtain labor certification, they must advertise for domestic workers to fill positions already occupied by the foreign worker. Streamlining the approval process, through a combination of steps including increased computerization and reduction in required steps, would benefit both employers and domestic workers.

These reforms may not be enough, however, to mend a clearly broken system. The weak support among employers for scrapping the current system makes it unlikely, however, that more fundamental changes will come easily. Employers rightly express reservations about untested policy changes, particularly in a policy arena in which bureaucratic failure has too often undermined well-meaning initiatives. Small-scale pilot projects that test alternative approaches may be a more palatable way to effect change.

APPENDIX: EMPLOYERS DEPENDENT ON H-1B SPECIALTY WORKERS

In 1998, Congress passed new legislation regulating employers' access to temporary specialty H-1B workers. The number permitted yearly into the United States was increased from 65,000 to 115,000, a user fee was implemented, and additional regulations were specified for employers who are deemed to be "dependent" upon H-1Bs. Research suggests that job shops exist where employers seek foreign temporary workers as their core workforce who, typically, they use on out contracting work and who they pay less than prevailing wages. While not prevalent in the employer community, this new legislation attempts to address such employment practices by identifying "H-1B dependent employers" according to the following formula:

- 50 or more full time employees, and at least 15 percent are H-1Bs,
- 26-50 full time employees, and at least 15 workers are H-1Bs,
- 25 or fewer full time employees, and at least 8 workers are H-1Bs.

The notion behind this formula is that employers with relatively large workforces of temporary workers may be able to pay less or, in some cases, be more apt to replace domestic workers with temporary H-1Bs. After all, the H-1B is unable to find employment elsewhere and, when there are few domestic workers in the company, the employer face little pressure to maintain working conditions that would keep domestic workers from leaving.

Four companies responded that they were specialty worker dependent; all had more than 50 full time employees and at least 15 percent of these are specialty workers. While this is a confidential survey and the employers have no concern they will be identified, their readiness to respond indicates once more employers' willingness to abide by the rules and regulations of immigration policy. They readily report their dependent status.

There are too few of these "H-1B dependent" employers in this sample to say much about them. They are neither the largest companies nor the smallest. Two "H-1B dependent"

companies had 2000 employees and 20 to 40 percent of their workforce was reported to consist of temporary foreign workers of all visa classes. Unfortunately, our questions do not allow us to know what which of these temporary workers are H-1B specialty workers. The smallest of these “H-1B dependent” companies had just 200 employees, nearly three-quarters of whom were temporary foreign workers of all visa types. This and of itself is neither surprising nor troublesome, it certainly is not a *de facto* indicator of likely visa violations. And the new law, once regulations are in place, would place greater regulations on these companies making violations rather less likely.

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Figure 1. Classes of Foreign-Born Workes Ever Hired

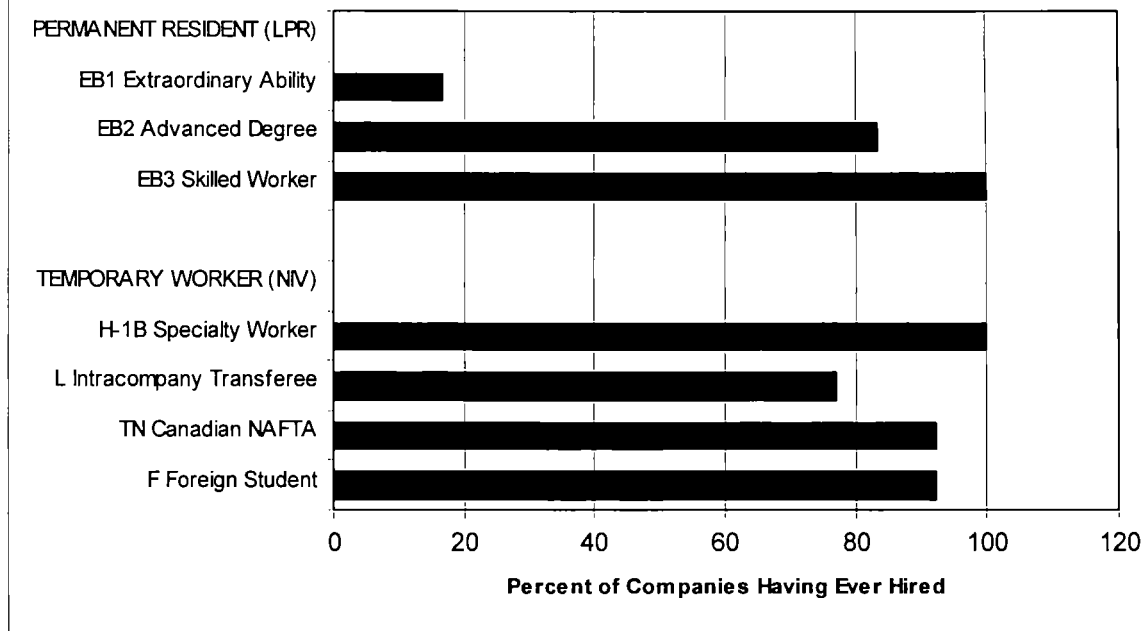


Figure 2. Median Company Size (Number of Workers)

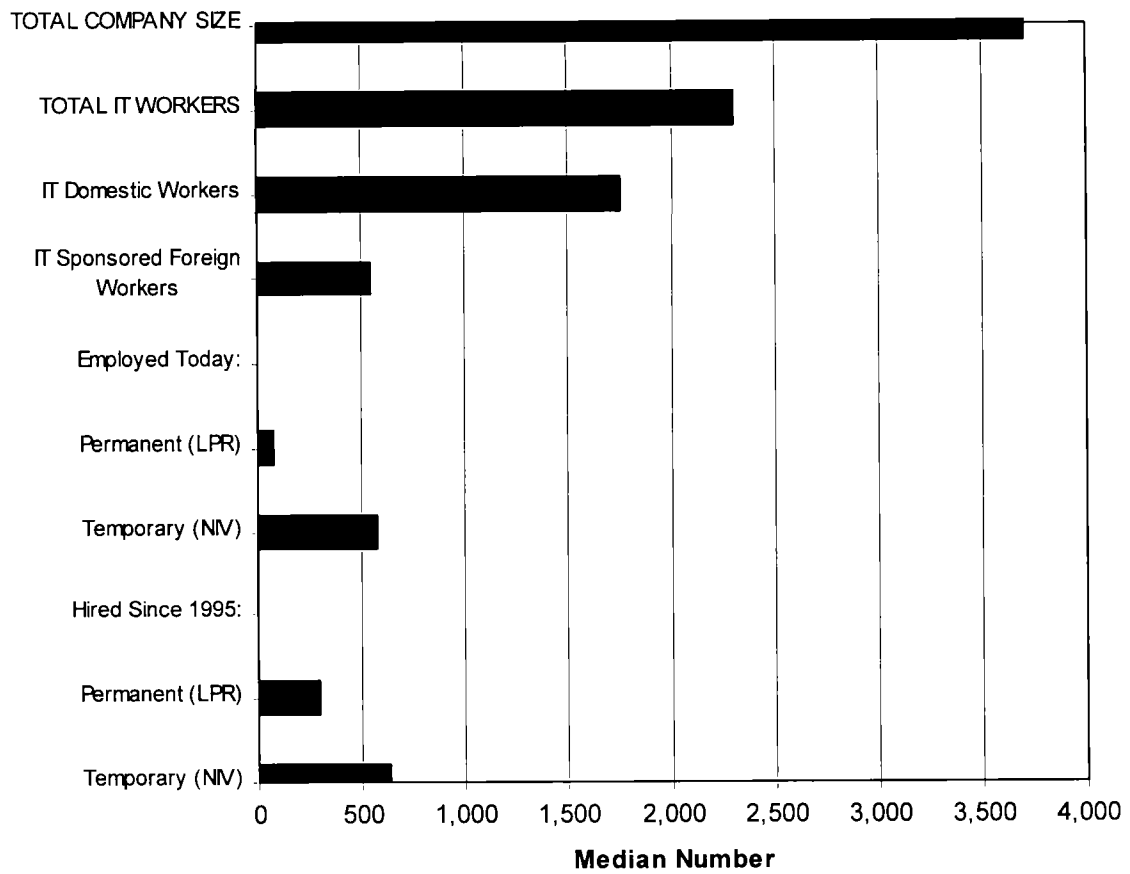


Figure 3. Reasons that Companies Hire Foreign Workers

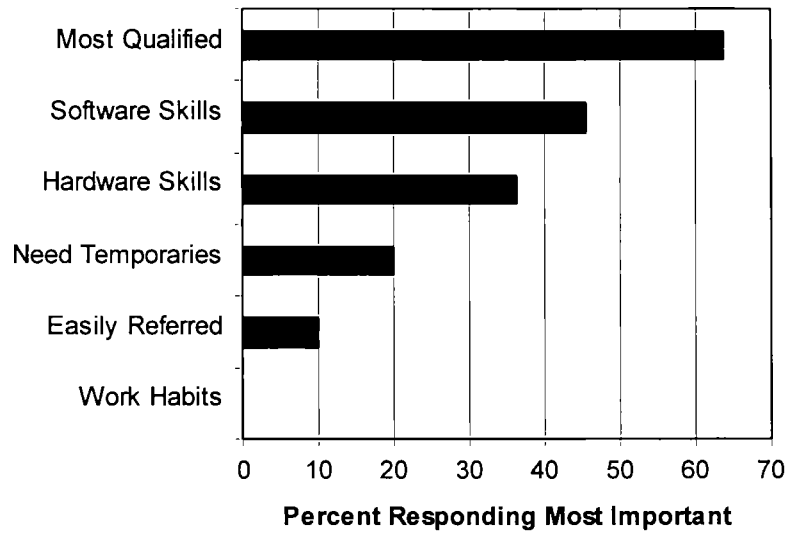
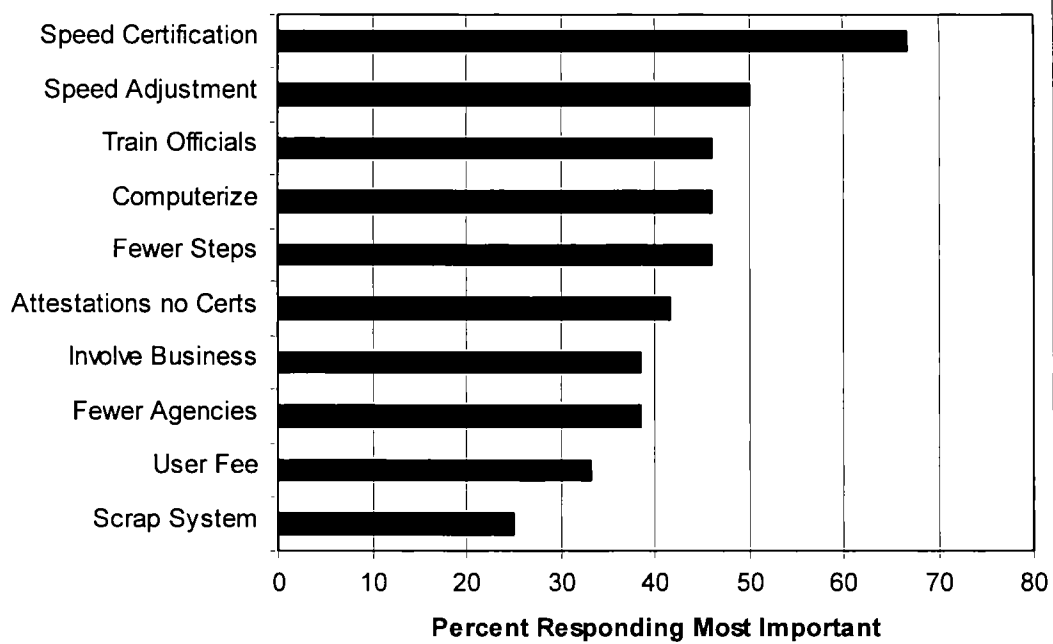


Figure 4. Steps to Improve the Approval Process



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B. Lindsay Lowell, Ph.D.
Director of Research
Institute for the Study of International Migration
Georgetown University

February 29, 2000

The Institute for the Study of International Migration (ISIM) is completing two years worth of research on high-skilled migrants. A broad variety of issues have been studied, I will present here highlights of our findings on data needs, what we have learned from IT companies, the labor market impacts of scientists and engineers, and some of the policy implications.

DATA ON SKILLED FOREIGN WORKERS

- Tracking the number of new migrants, their skills, the population working in the United States, and outcomes: data available from INS, NSF, and Census Bureau all have major flaws.
 - Given the current state of affairs, and past methods of addressing statistical lacunae, policy debates will continue in a knowledge vacuum.
 - Improvements in statistical knowledge should include periodic *non-administrative* samples of immigrant classes.
 - Improvements in *administrative* statistical gathering are not possible without restructuring and granting autonomy and power to statistical branches at major institutions such as the INS.
- Counting and Analyzing H1Bs in the labor force: standard surveys and data sources are limited.
 - Census/Dept. of Labor Current Population Survey (CPS) misses most H1Bs and other temporary workers (e.g., the most widely used intercensal data on immigrants).
 - ISIM's *preliminary demographic* estimates show that current levels of H1B admissions will peak in 2001 at just under 0.5 million and that nearly 50 percent of entering H1B cohorts will adjust to permanent status (or attempt to).
 - Indirect CPS-based estimates show numbers of only at most 65,000 H1Bs up thru 1999 (immigrant status is not given and must be *imputed* in CPS data).
 - Implication — while valuable, CPS-based analyzes of the information technology labor force understate possible H1B effects.

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INFORMATION TECHNOLOGY COMPANIES & FOREIGN WORKERS

- *"INS Top H1B Users"* analysis by ISIM: Dunn & Bradstreet company characteristics of these large users of H1Bs.
 - INS "Top H1B" users are predominantly in the IT industry.
 - INS "Top H1B" users are different from the IT industry generally, i.e., they are larger in size and sales, they are East not West coast, and their CEOs are predominantly South Asian.
- *"Fieldwork & ITAA survey"* of employers by ISIM: characteristics and preferences of IT employers.
 - These companies are a good picture of frequent users of H1Bs, as well as, Canadian TN and permanent immigrants.
 - These companies are large, and they show substantial retention of temporary workers, but substantial turnover of newly permanent immigrants.
 - The majority of these companies report that they hire foreign workers because they are "the most qualified" (work habits or referrals play little role).
 - These companies are most concerned with the time it takes to get temporary workers certified and adjusted to permanent LPR status.
 - These companies would train officials, computerize, and move to attestations, but they would NOT scrap the current system.

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STUDIES OF SKILLED FOREIGN LABOR

- Most research finds little or no adverse impact of foreign *skilled* workers on the private sector.
- Some research suggests that large numbers of foreign skilled workers and foreign students may adversely affect the academic sector, especially in post-graduate training in the sciences, but the findings are not conclusive.
- Specific visa classes are rarely identified in such research, but the available work suggests that for H1Bs:
 - The implication of most research is that the majority of employers are good actors and that H1Bs benefit the U.S. economy at no expense to U.S. workers.
 - Yet, field work and enforcement actions make it clear that "job shops" do exist that exploit H1Bs, some H1B hiring undercuts U.S. workers, and H1Bs can retard normal market adjustments to shifts in supply and demand. The degree of such undesired effects are unknown, but cumulatively they cannot be disregarded.
 - Preliminary research by ISIM suggests that recent immigrants in IT occupations are 3 times as likely to be "contingent" workers than are natives and they earn substantially less than natives. Further, while the earnings on non-contingent IT workers increased 1995-1999, the wages of the contingent IT workers have been stagnant.

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A FEW POLICY IMPLICATIONS

- The H1B visa cannot be dealt with in isolation, there are other work-related temporary visas that fill many of the same occupations.
- There is no apparent reason not to have a generous program to meet employers' needs for foreign labor, but the sum total of working visas including the H1B and NAFTA TN, as well as the student F and exchange J, are generous at today's levels.
- Temporary visas, especially the H1B, are intrinsically linked to the permanent LPR system... and always to the principles that constitute the U.S. system of immigration and its model of citizenship.
- The genius of the USA immigration system is that newcomers have a stake in our society and we a stake in their ultimate settlement and citizenship. Historically, there has been no large, legally-sanctioned class of migrants whose rights and whose stakes in the U.S. are seriously circumscribed.
- The permanent LPR system is broken and this puts pressure on employers to use the H1Bs and other temporary visas.

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Core Occupations of 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 first of a series to be released during early 1999, provides a general overview of the IT workforce. Additional reports will assess production of academic degrees in IT disciplines, data on foreign-origin workers, and 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.

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January, 1999

Information technology (IT) is "the study, design, development, implementation, support, or management of computer-based information systems."¹ In practice, IT includes all production and all applications of hardware and software. Leadership in information technology is commonly believed to be essential for the health of the U.S. economy. IT industry associations have been saying that this leadership is threatened by shortages of qualified workers.²

The industry utilizes a very broad range of skills. For example, hardware manufacturing relies on mechanical, chemical, and other engineering skills as well as the services of electrical and electronic engineers. Although a list of all the occupations involved in IT would be quite large, observers of the industry agree that a small set of fields — computer scientists, computer engineers, systems analysts, and programmers — constitutes the "core" of the information technology workforce.³ In the United States at the beginning of 1999, these four core IT occupations employed over 2.2 million people.

Counting IT workers

The U.S. government is the authoritative source of statistics on the labor force. Three independent estimates of the number of core IT workers are available from federal sources:

- The most up-to-date data (through 1998) are provided by the *Current Population Survey* (CPS), a joint project of the U.S. Bureau of Labor Statistics (BLS) and the Bureau of the Census. Information comes from monthly surveys of 47,500 households.
- BLS's *Industry/Occupation Matrix* is a major source of data for the biennial *U.S. Occupational Outlook Handbook*. Assembled from surveys of establishments, the matrix contains employer-based estimates of occupation by industry. It is the only well-established source for forecasts of occupational trends. The most recent edition of the matrix was released in late 1997 and provides data for 1996 plus projections to 2006.
- *SESTAT*, the Scientists and Engineers Statistical Data System, is a project of the National Science Foundation. Updated every two years, SESTAT is scheduled to add new data from 1997 during the next few months, but when the work for this report was done, the most recent numbers were those for 1995. SESTAT contains information on many characteristics of IT workers, and supports the production of special tabulations for specific research projects.

¹ Information Technology Association of America (ITAA), cited in Carolyn M. Vereri, "Here Today, Jobs of Tomorrow: Opportunities in Information Technology," *Occupational Outlook Quarterly* 42:3 (Fall, 1998), pp. 44-57.

² For example, see *Help Wanted: The IT Workforce Gap at the Dawn of a New Century* and *Help Wanted 1998: A Call for Collaborative Action for the New Millennium*, both from the Information Technology Association of America (Arlington, Virginia, 1997 and 1998).

³ All of the previously cited materials use this definition of the core IT professions. A slightly broader set of occupations is discussed in Vereri's text, *op.cit.*, but her statistics are for the "core" fields only.

Data on core IT occupations from all three of these sources are presented in the exhibit below. The first section of this table compares results from the CPS in 1995 (annual estimates are averages of the twelve monthly figures) with NSF's SESTAT data for the same year. For the computer scientists, computer engineers, and systems analysts, agreement between the two sources is good, especially when differences between these data bases are considered. Information in the CPS comes from face-to-face interviews with one representative at each household, who supplies information on occupations for everyone at that location. Thus some of the data are second-hand. The personnel who conduct the CPS are trained to deal with this problem, but Census staff acknowledge that they might get different information if they were able to talk directly to every jobholder.

Methods for collecting SESTAT's data are different. NSF conducts three separate surveys using a mix of mailed questionnaires and telephone interviews: the National Survey of College Graduates, additional National Surveys of Recent College Graduates, and the Survey of Doctorate Recipients. Data from these separate studies are then com-

bined to yield estimates for the entire scientific and engineering workforce. Unlike the CPS, everyone in the SESTAT data base has been contacted directly, so information about their occupations is never filtered through intermediaries like other household members.

There are some gaps in SESTAT's coverage of IT workers. The data exclude persons who have neither a U.S. bachelor's degree nor experience before 1990 in a science or engineering job. They also omit those with nonscience or nonengineering bachelor's degrees earned after 1993 and who did not have jobs in science or engineering before April of that year. SESTAT's numbers do include 23,000 computer science professors.

NSF does not consider programmers to be scientists or engineers, so SESTAT yields only a partial count of those workers, limited to people with a bachelor's or higher degree (and as noted above, not everyone with those degrees is included). For this reason, the CPS data are better than SESTAT for estimates of the number of programmers.

The next section of the table compares CPS data for the following year, 1996, with BLS Industry/Occupation Matrix results for that year. Fewer computer scientists, computer engineers, or systems analysts are reported

by the establishment surveys done for the matrix than by the household interviews conducted for the CPS. At least a portion of this difference may be due to the use of a separate job title in the establishment surveys, grouped with managerial and administrative occupations, for engineering, science, and computer systems managers. In 1996, 343,000 persons were classed in this group by their employers. Some IT professionals who think of themselves as computer scientists or other "core" IT workers, or who might be reported in those occupations by other household spokespersons in the CPS interviews, may be counted by their employers as technical managers.

The CPS and BLS matrix data for 1996 are in close agreement on the number of programmers. In general, we think the Current Population Survey statistics are a good indicator of the size of the core IT workforce.

Growth of the core occupations

The third part of the table provides CPS data for 1998. The average for the first three quarters of the year is our best estimate (as of the time this report was prepared in December, 1998) of the eventual annual twelve-month average for the year. The most recent monthly results, for November,

Estimates of the Number of Core IT Workers in the U.S.

NOTE: all figures rounded to nearest 1,000

Year and Source	Computer Scientists, Computer Engineers, & Systems Analysts	Programmers	Total	Notes
1995: Current Population Survey	933,000	553,000	1,486,000	
1995: SESTAT (NSF)	910,000	205,000	1,115,000	College graduates only. Programming is not treated as an S&E field by NSF. Includes 23,000 computer science professors
1996: Current Population Survey	1,093,000	561,000	1,654,000	
1996: BLS Industry/Occupation Matrix	934,000	568,000	1,502,000	343,000 engineering, science, & computer systems managers are grouped with Managers & Administrators. See text
1998: Current Population Survey (average, first three quarters)	1,482,000	602,000	2,084,000	
1998: Current Population Survey (latest results for November)	1,549,000	668,000	2,217,000	
2006: BLS Industry/Occupation Matrix	1,937,000	697,000	2,634,000	498,000 engineering, science, & computer systems managers are grouped with Managers & Administrators

1998, are the source of our estimate of "over 2.2 million people" in core IT occupations by early 1999.

The last part of the table supplies BLS matrix projections for the core IT fields in 2006. The Bureau believes that computer scientists, computer engineers, and systems analysts will be the three fastest growing occupations in the nation. They are also expected to be among the fields that will generate the largest absolute numbers of new jobs during the ten-year period projected by BLS—over a million new positions by 2006. Much of this growth has already been realized since these forecasts were made in 1997.

At the same time, BLS projects only minor growth for programmers. The forecast of 697,000 people employed in this occupation in 2006 is only 23 percent higher than the Bureau's estimation of actual employment in this field in 1996. These expectations of very rapid growth for the "higher" IT professions, but much slower growth for the programmers, are consistent with historical trends for these occupations, summarized in the graph at the right. Since 1983, the numbers of computer scientists, computer engineers, and systems analysts counted by the CPS have increased 537 percent (using the average for the first three quarters of 1998 as a stand-in for the eventual final figure for the entire year, which will be even higher). During the same period, growth for programmers has been much slower, only 36 percent. What accounts for this discrepancy between programmers and the other core IT occupations?

Why growth in programming is slow

The disconnect between demand for programmers and that for other kinds of IT specialists is acknowledged by the industry. To illustrate, a recent trade publication⁴ reports that "An August survey of 100 contracting and consulting firms by the Information Technology Association of America (ITAA) showed that the 'overwhelming majority' have more programmers than they can use." The report notes that demand is for project managers, not "worker bees," and it observes that "The supply of year 2000 programmers has been bigger than expected because many corporations outsourced coding to

offshore companies, vendors developed year 2000 tools that automated much of the coding process, and schools and training facilities graduated a bumper crop of programmers geared to the job."

These remarks suggest some of the reasons why growth is slow for the programmers. Higher-level computer scientists design software, identifying key variables, specifying program modules for manipulations of data, and determining flows of operations and linkages needed to carry out a set of desired tasks. Once this work has been done, lower-level coding can be broken up into many separate pieces and farmed out, and increasingly that work is going to inexpensive job shops in places like Bangalore, India.

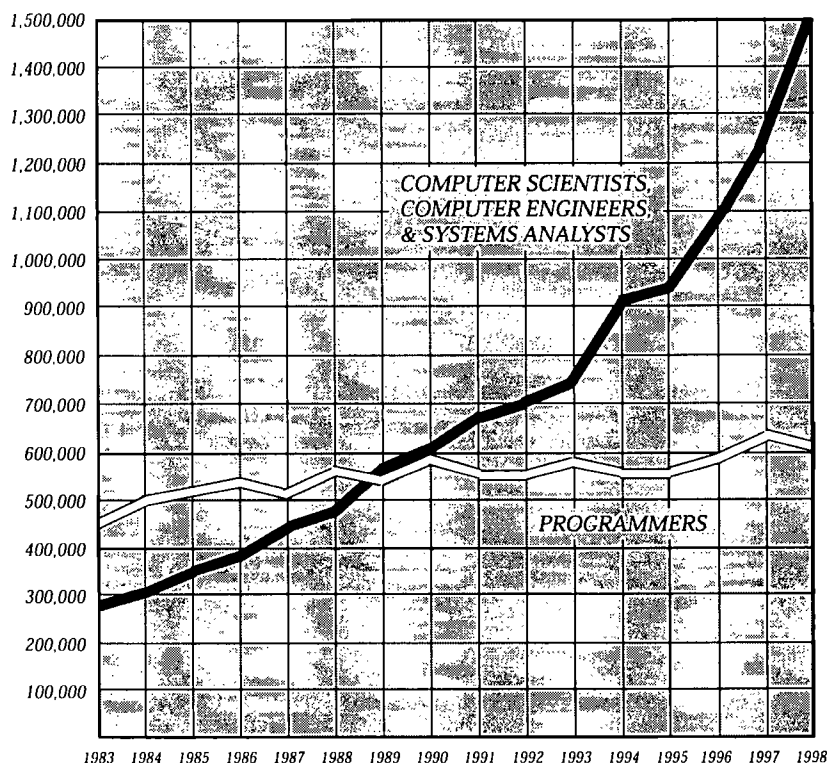
Furthermore, programming is itself being automated, as illustrated by the year 2000 tools mentioned in the news report cited above. Tools such as CASE (Computer Aided Software Engineering) allow practitioners to concentrate on the special aspects of software development projects, eliminating much of the drudgery associated with the creation of programs. The use of similar tools in

other branches of engineering has greatly reduced the need for support from draftsmen and other technicians. With computer-aided design, a single professional can do work that once required whole teams of people. This applies to software engineering just as it does to other types of practice.

Tools like CASE create pressures from above that reduce the need for programmers, so that more senior people can use automated systems to create code instead of passing much of this work to lower-level assistants. Continued development of other kinds of tools creates similar pressures on programmers from below. Some recent comments on the profession from BLS illustrate this trend: "Advanced programming languages and new object-oriented programming capabilities are increasing the efficiency and productivity of both programmers and users. The transition from a mainframe environment to a primarily PC-based environment has blurred the once rigid distinction between the programmer and the user. Increasingly, adept users are taking over many of the tasks previously performed by programmers. For

Growth in Core IT Occupations, 1983-1998

Source: Current Population Survey annual averages (first three quarters for 1998)



⁴ Kathleen Melymuka, "Millennium Superstars," *Computerworld*, October 5, 1998.

example, the growing use of packaged software, like spreadsheet and data base management packages, allows users to write simple programs to process data and perform calculations.”⁵

Programming remains at the heart of all IT work and it is not going to disappear as a profession. Demand for IT specialists is so strong that growth is still forecast for programmers despite effects of outsourcing and automation. Needs for “worker bees” may be diminishing, but interest in the queens and kings of programming is as great as ever. At the top of the field are the gifted practitioners described by Randall E. Stross: “The best programmers are not marginally better than merely good ones. They are an order of magnitude better, measured by whatever standard: conceptual creativity, speed, ingenuity of design, or problem-solving ability.”⁶ At this level, programming is an elite profession.

It is also a field that is remarkably indifferent to formal education. As Clifford Adelman of the U.S. Office of Educational Improvement puts it, “The computer field has honored competence, content and creativity more than credentials.”⁷ The latest editions of the *U.S. Occupational Outlook Handbook* rightly advise that college degrees have become a standard requirement for programmers, but nevertheless newspaper reports continue to tell us about practitioners without degrees, in their twenties or even their teens, making \$50,000 a year or more.⁸

Demand for software development skills is so strong that data on the placement of recent college graduates show that programming talent is what many employers seek when they hire computer scientists, electrical engineers, or math majors. These workers

may not be called programmers, but programming is a large part, in some cases the most crucial part, of what many of them have been hired to do.⁹

Where core IT people work, and other demographic traits of the workforce

The BLS Industry/Occupation Matrix provides data on the sectors where IT specialists work (see table, below). Automation has spread throughout the economy and these workers are found everywhere, not just in the IT industry itself. The workforce is concentrated, however, in computer and data processing services, a single industry category that employs more of these people than does all of manufacturing. Like the fields on which it depends, this is the fastest growing employment sector in the nation. Other sectors with large shares of IT workers include finance, wholesale and retail trade, and government.

⁹ See Weatherall, *op. cit.*, and also his similar 1998 report, “The Strongest Market in Years for New Graduates,” *ENGINEERS* 4:2 (April, 1998), pp. 2-9.

Using Current Population Survey data for the 2,084,000 persons in the core IT professions in 1998 (again, using the average for the first three quarters of the year):

- 73 percent of these workers are men, compared to a little more than half of the entire civilian labor force.
- On the average, they are 37 years old — younger than the U.S. labor force as a whole.
- They are highly educated. Just six percent have only a high school diploma. 26 percent, mostly programmers, have associate or other two-year vocational degrees. 48 percent have bachelor's degrees; 19 percent have master's, doctorate, or other graduate degrees.

The next report in this series will examine the education of core IT workers in more detail. Less than half of them have completed formal training at the bachelor's level in appropriate IT disciplines, even when minor areas of concentration are counted as well as the major fields associated with each degree. Of all those people who do have this kind of training, more than a third are *not* IT workers.

Employment Sectors for Core IT Workers

NOTE: rounded to nearest 1,000. Due to rounding, components may not sum to totals

Employment Sector	Computer Scientists and Systems Analysts	Computer Engineers	Programmers	Total
Manufacturing:				
Electrical & Electronic plus Precision Instruments	26,000	38,000	13,000	77,000
Computers & Office Equipment	16,000	15,000	14,000	45,000
Chemicals, Drugs, Plastics & Petroleum Products	19,000	3,000	6,000	28,000
Aerospace & Shipbuilding	15,000	4,000	7,000	25,000
All Other Durable Goods	26,000	7,000	14,000	48,000
All Other Nondurable Goods	30,000	1,000	14,000	44,000
Subtotal, Manufacturing	132,000	69,000	67,000	268,000
Services:				
Computer & Data Processing	136,000	76,000	192,000	404,000
Finance, Insurance & Real Estate	82,000	4,000	78,000	165,000
Wholesale & Retail Trade	61,000	—	41,000	102,000
Engineering & Research/Testing Laboratories	18,000	21,000	21,000	59,000
Management & Accounting	21,000	11,000	20,000	52,000
Health	26,000	2,000	11,000	38,000
Communications & Broadcasting	13,000	3,000	10,000	26,000
Electric & Gas Utilities	11,000	1,000	4,000	16,000
All Other Services & Utilities	70,000	12,000	69,000	151,000
Subtotal, Services	437,000	129,000	447,000	1,013,000
Government:				
Federal (including Postal Service)	59,000	3,000	8,000	70,000
State & Local	46,000	—	26,000	72,000
Subtotal, Government	105,000	3,000	34,000	141,000
All Employment Sectors Combined	674,000	201,000	548,000	1,422,000
Self Employed	44,000	15,000	20,000	79,000
Total	718,000	216,000	568,000	1,502,000

Source: Bureau of Labor Statistics, Industry/Occupation Matrix, baseline data for 1996

⁵ “Computer Programmers,” *U.S. Occupational Outlook Handbook 1998-99* (Washington: U.S. Department of Labor, 1998).

⁶ *The Microsoft Way* (Boston: Addison-Wesley, 1996), p. 39, cited in Robert K. Weatherall, “A Booming Market for New Graduates,” *ENGINEERS* 3:2 (April, 1997), p. 11.

⁷ *Leading, Concurrent, or Lagging: The Knowledge Content of Computer Science in Higher Education and the Labor Market* (Washington: U.S. Department of Education, 1997), p. 40.

⁸ For example, see Peter Behr, “Getting It Right on the Money,” *Washington Business*, September 21, 1998, p. 12.

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The Production of U.S. Degrees in Information Technology Disciplines

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 second in a series to be released in early 1999, looks at the production of people with appropriate academic degrees. Our previous report provided a general overview of the IT workforce. Additional reports will assess data on foreign-origin workers and 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.

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January, 1999

The previous report in this series examined the "core" information technology workforce in the United States, comprised of computer scientists, computer engineers, systems analysts, and programmers. Data from the federal Current Population Survey show that at the beginning of 1999, more than 2.2 million people were employed in these professions.

Less than half of these workers have bachelor's or higher degrees with completed major or minor concentrations of study in an IT-related discipline. Using data from the National Science Foundation, the National Center for Education Statistics, and the Engineering Workforce Commission of the American Association of Engineering Societies, we estimate that by the end of 1998, more than 860,000 college graduates in the U.S. had earned bachelor's or higher degrees in information technology fields — computer and information science or computer engineering. This figure includes graduates with bachelor's degrees in electrical engineering if they also reported second majors or minor fields of study in computer science or related IT specialties.

In addition, by 1995 there were well over 116,000 other graduates without IT degrees as such, but who had combined majors in other fields with a minor concentration or second major field of study in an IT discipline. Over half of these persons earned undergraduate degrees in math or in other engineering specialties, making them virtually indistinguishable from persons with IT degrees *per se*. When allowance is made for similar graduates since 1995, roughly one million college graduates can be identified whose education has included preparation for IT work — but even this number is still well short of half the current workforce. In fact, the presence of graduates with IT-related degrees in information technology is considerably lower than even these figures suggest, because well over a third of the graduates with appropriate degrees do not work in the four core IT professions.

This raises the question of what sort of training IT workers *do* have. The table below draws on the National Science Foundation's SESTAT data base on scientists and engineers for information on

Academic Origins of Degreed IT Workers

Educational Backgrounds in 1995 of Employed Computer Scientists,
Computer Engineers, Systems Analysts, and Programmers

	Percent
IT degree: B.S. or higher, in Computer Science or Computer Engineering	41%
No IT degree, but completed undergraduate minor or second major in CS/CE	5
Neither of the above, but:	
Other engineering bachelor's degree	19
Social science bachelor's degree	8
Natural science bachelor's degree	7
Business bachelor's degree	6
Math bachelor's degree	5
Other bachelor's degree	6
No bachelor's degree (first degree at master's level or higher)	2

Source: NSF SESTAT data; excludes many of the programmers, who are not treated by NSF as part of the scientific and engineering workforce. All groups include people with additional higher degrees, as well.

roughly 1.1 million college graduates employed in IT occupations in 1995. About 41 percent of these workers had earned undergraduate or graduate degrees in IT fields. Another five percent had not earned IT degrees as such but did complete undergraduate minor concentrations of study or second majors in an IT discipline.

The remaining IT workers covered by SESTAT's data came from a wide range of academic backgrounds. In some cases, the education of these other workers may have been quite similar to that of people with more obvious academic credentials for IT careers. For example, 19 percent of the IT workforce had earned undergraduate engineering degrees (other than IT degrees as such). Another 12 percent had degrees in natural science or math. Some persons with such backgrounds may be as well prepared for an IT career as other persons who have degrees in computer science. Much depends on the way that particular colleges or universities are organized, on the specific mix of courses that students take, and on an employer's needs.

Degree titles are often ambiguous. Universities do not adhere to uniform practices in labeling their graduates. Also, degree terminology evolves over time; the words that describe particular kinds of expertise change as fields emerge and mature. "Computer science" itself has grown from a specialty within electrical engineering into a separate discipline, and thus we know that some persons trained solely as "electrical engineers" may in fact be fully qualified IT specialists. The problem is that the available statistical sources provide no sure way to distinguish those graduates from other kinds of EE's with very different areas of competence. We have used information on minor fields of specialization to help resolve this dilemma; see below for more information.

It is also possible for IT workers with academic backgrounds in social science or business to have acquired substantial IT skills in school, but in general the connection between these branches of scholastic training and work in information technology is more tenuous than the linkage between electrical engineering and

IT. Some of the business or social science majors are likely to be less rigorously prepared than persons with engineering or math degrees, to say nothing of persons with even more explicit credentials for careers in IT (such as degrees in computer science or computer engineering). However the data are interpreted, it is clear that IT workers vary widely in the nature and depth of the academic training they have obtained.

People with IT degrees

The estimate of over 860,000 college graduates in the U.S. with bachelor's or higher degrees in specific IT disciplines is based on information from NSF's SESTAT data base on the science and engineering workforce in April, 1995, augmented with data on subsequent degree awards through the end of 1998. SESTAT is a good source for these estimates because it includes details on earned degrees at the bachelor's, master's, doctorate, and professional levels. No other federal source supports accurate counts of persons with an IT degree at *either* the bachelor's or a higher level. This capacity is crucial; over a quarter of the persons who have at least one IT degree obtained this credential after originally getting a bachelor's degree in some other discipline.

SESTAT's data are not perfect. They include some people who earned IT degrees outside the United States, but they do not pick up persons with foreign degrees who entered the IT workforce in this country after 1990.¹

The persons with IT degrees who have been counted here include anyone with a bachelor's or higher earned degree in the following disciplines: computer and/or information science, computer systems analysis, information services and systems, a residual group of "other" computer and information science programs, and computer and systems engineering.

As noted above, electrical engineers are included in the count of people with IT degrees if they also reported minor or second major areas of study

Persons in the U.S. with IT-related College Degrees

Group	Number	Source Data
I. Persons with an earned IT degree, as of 4/15/95:		
A. First bachelor's degree in an IT specialty	528,091	Data from the National Science Foundation's Scientists and Engineers Statistical Data System (SESTAT). "IT degrees" include all bachelor's or higher degrees in computer & information science, computer & systems engineering, and a small number of awards in programming or data processing. Electrical engineering degrees are included if their recipients also reported second majors or minor areas of concentration in computer science or computer engineering.
B. First bachelor's degree NOT in an IT specialty, but recipient of graduate IT degree	195,456	
Total degrees as of April 15, 1995	723,547	
II. Subsequent IT degree awards:		
A. In 1995	33,972	For awards in computer and information science in 1994-95, see THE CONDITION OF EDUCATION 1997 (Washington: National Center for Education Statistics, 1998), Table 283, p. 309; for 1995-96, see Frank B. Morgan, DEGREES AND OTHER AWARDS CONFERRED BY DEGREE-GRANTING INSTITUTIONS (Washington: National Center for Education Statistics, September 1998), Tables 4b-d, pp. 15-24; figures for 1996-97 and 1997-98 estimated by using NCES data for 1995-96. For degrees in computer engineering from 1994-95 through 1996-97, see ENGINEERING AND TECHNOLOGY DEGREES 1997 (Washington: Engineering Workforce Commission of the American Association of Engineering Societies, 1998), Tables 5-7, pp. xiii-xv; the figure for 1997-98 is estimated by using the Commission's data for 1996-97. In all cases, counts of people earning IT degrees after early 1995 were derived by adding one-third of the number of new master's degrees to the total number of new bachelor's awards. See text for further comments.
B. In 1996	34,314	
C. In 1997	35,000	
D. In 1998	35,000	
Total subsequent degrees, through 1998	138,286	
III. Total persons with IT degrees at the end of 1998		
	861,833	
IV. Addenda:		
No IT degree, but undergraduate work includes a second major or academic minor in an IT specialty (1995 data only)	116,427	Data on undergraduate minors in IT specialties and on postgraduate enrollment in IT programs are from SESTAT. The figure for associate degree awards in computer and information science in 1995-96 are from Morgan, op.cit., Table 4a, page 12.
Enrollment in postgraduate IT programs by persons with no prior IT degrees, April, 1995	9,515	
Associate degrees in IT, 1996	9,658	

¹ SESTAT has another weakness for general IT workforce studies, because NSF does not consider programming to be a scientific or engineering profession. In general, the programmers included in the SESTAT data base are limited to those with science or engineering degrees at the bachelor's level or higher. For present purposes this drawback presents no major problems, and this report includes data on more than 200,000 programmers with B.S. or higher degrees.

in computer or information science or in computer engineering. This step results in adding 41,100 EE's to the count of trained IT workers in 1995. Another 31,710 EE's earned graduate degrees in IT disciplines and are included in the count for that reason (see the table below right). Together, these two groups comprise roughly ten percent of both the total population of EE's and the total count of persons with IT degrees in 1995. As noted above, information technology has arisen from the work of electrical engineers, and estimates of the number of appropriately degreed people should allow for them. However, it would be a mistake to treat *all* EE's as IT specialists. For example, persons whose competence is in the electrical power industry or in electromagnetics and radiation should be excluded. One check on the approach we have used is provided by IEEE-USA's 1997 compensation survey,² which indicates that about 24 percent of the members of this association have primary areas of technical competence in computer hardware or software. IEEE members include computer scientists and com-

puter engineers as well as conventional EE's, so an adjustment that adds about ten percent of the EE's to the population of degreed IT workers seems reasonable.

The SESTAT statistics also include a small number of people with bachelor's or higher degrees in programming or data processing. All estimates are of trained people, not total degree awards; persons with two or more IT credentials are counted once only.

One breakdown of the estimate of degreed IT professionals in 1995 is provided in the table on the opposite page; two others appear below left. These data confirm that while most IT graduates were trained in computer science, computer engineers add significant numbers of people to this supply of graduates. Advanced degrees are common, held by more than a third of these persons. Information technology is a relatively new field; many persons not originally trained in it have acquired credentials by earning master's degrees.

Overall, SESTAT yields an estimate of 723,547 degreed IT specialists as of April, 1995. Since then, there have been more graduates. To bring the numbers up to date, data on degree awards from 1995 through 1998 were added to the SESTAT results, as noted in the table on page two. In

each case, the total number of newly trained professionals was calculated by adding one-third of the number of new master's degrees to the total number of new bachelor's awards. This "one-third rule" allows for awards of IT graduate degrees to persons who did not obtain their credentials at the undergraduate level. Other data in SESTAT, noted in the "Addenda" section at the bottom of the table on the opposite page, show that 9,515 people who had not earned other IT degrees were enrolled in IT graduate programs in 1995. Master's degrees can often be completed in two years or less; if half of these students received their degrees by the end of 1995, this provided more than enough graduates to meet the assumptions of the estimation model (one-third of all new IT master's degrees).

These procedures yield an additional 138,286 persons with bachelor's or higher IT degrees by the end of 1998, or 861,833 trained IT professionals overall. In addition, SESTAT's data for 1995 identify 116,427 persons who never earned IT degrees *per se* but did complete undergraduate second majors or minor fields of study in an IT discipline. Many of these graduates were math, natural science, or other engineering majors. Such graduates can be as attractive to industry recruit-

IEEE U.S. Membership Salary and Fringe Benefit Survey 1997 (Washington: IEEE-USA, 1997), Exhibit 2-7, p. 2-5.

Specialties of People With IT Degrees, 1995

(Note: sums to more than 100%, because a few persons qualify in more than one way)

Degree Type	Number	Percentage
Computer Science and Related Fields	603,090	83.4%
Computer/Systems Engineering ¹	110,472	15.3
Programming and Data Processing	19,824	2.7

¹ Includes qualified EE's with CS/CE minors; see text
Source: SESTAT. See citations in table, p. 2

Highest Degrees of People With IT Degrees, 1995

(Note: highest degrees are not necessarily degrees in an IT field)

Degree Level	Number	Percentage
Bachelor's	471,804	65.2%
Master's	226,749	31.3
Ph.D.	20,731	2.9
J.D./M.D.	4,263	0.6

Source: SESTAT. See citations in table, p. 2

Original Undergraduate Major Fields for Those Who Obtained IT Degrees at the Graduate Level, and for Those with Undergraduate IT Minors or Second Majors

Undergraduate Major Field	IT Credentials from Graduate Degree		IT Credentials from Undergraduate Minor	
	Number	Percent	Number	Percent
Electrical Engineering ¹	31,710	16.2%	(N/App) ¹	—
Other Engineering	18,739	9.6	9,988	8.6%
Engineering Technology	3,700	1.9	3,633	3.1
Mathematics ²	33,868	17.3	50,625	43.5
Natural Sciences	27,094	13.9	10,129	8.7
Social Sciences	18,740	9.6	14,799	12.7
Business/Finance ³	23,620	12.1	24,033	20.6
Other Bachelor's Degrees	33,587	17.2	3,220	2.8
No Bachelor's Degree ⁴	4,398	2.2	(N/App) ⁴	—
Totals	195,456	100.0%	116,427	100.0%

Source: SESTAT. See citation in table, p. 2. Notes:

¹ 41,100 graduates with BSEE's and minors or second majors in IT fields treated as full-fledged IT degrees. See text.

² Includes actuarial science.

³ Includes marketing.

⁴ Persons whose first degree was a master's or better. Such awards are available in engineering (for example, at the University of Louisville and at MIT) as well as in many other disciplines.

ers as those with conventional IT degrees.³

Other types of IT preparation

Some IT specialists, particularly programmers, do not have college degrees. Current Population Survey data for 1996 showed that 10 percent of the programmers had only high school diplomas, 21 percent had attended college without earning a degree, and 10 percent had associate or other two-year vocational diplomas. The two-year programs are aimed at paraprofessionals and include training in repair and service technology as well as computer science. The table on page 2 notes that 9,600 of these kinds of degrees were awarded in 1996.

Another type of IT credential that may be possessed by many people without university degrees in the field are the certifications associated with major software firms, such as Novell Certified Network Engineers (CNE's). By late 1998, 150,000 people had obtained this certification. Novell also issues other types of certifications. Microsoft has eight IT certification programs including the MCSE (Microsoft Certified Systems Engineer) and MCSA (Microsoft Certified Solution Developer). Over 270,000 Microsoft Certified Professional (MCP) credentials have been issued. Unfortunately, current data provide no way to measure the overlap among those with these certificates or with those who also have an IT college degree.

A high level IT certification program is provided by the Institute for Certification of Computing Professionals. Candidates must satisfy both examination and experiential requirements. At the end of 1998, 50,000 persons had received CCP credentials.

Persons with IT skills who don't work in the four core occupations

The IT industry has asserted that the health of the U.S. economy is threatened by inadequate supplies of trained IT specialists and that "American universities are not graduating students in adequate numbers or with sufficient skills to fill the growing demands of U.S. companies."⁴ Given this de-

mand for qualified people, explanations are needed for the fact that more than a third of those who do have college-level IT credentials are not employed in "core" occupation jobs. The table in the middle of this page shows that in 1995, 37 percent of those with degrees in IT disciplines did not hold core IT positions. Even less use was being made of graduates with IT minors or second majors.

In any field, some degreed people do not go on to practice their profession, while others are promoted out of technical careers into management. Adequate analysis of differences between degreed IT specialists who are or are not working as technical specialists in the field is beyond the capacities of this report. Studies of the career paths of people with IT training will need to test such factors as the amount of IT experience which people working outside the core occupations have, whether their current positions are still IT-related, their earnings, and other clues. A preliminary analysis of this kind is feasible now, using data from SESTAT, and will be a sensible

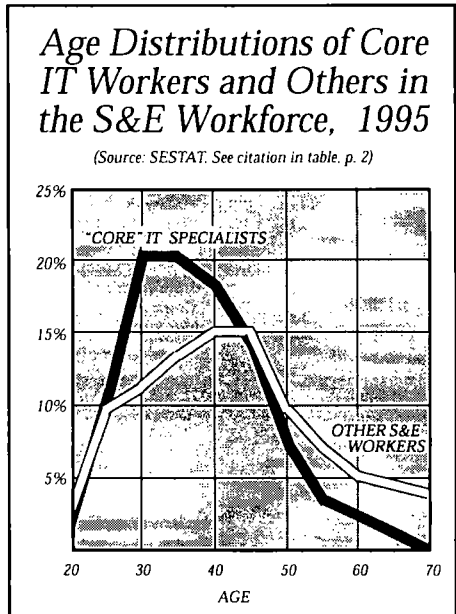
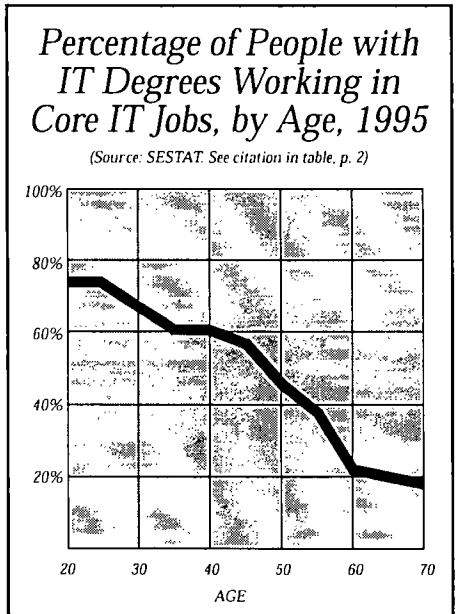
further step in assessing the placement of people with core IT training.

One factor associated with IT employment has been briefly reviewed for this report: people with IT degrees who do not work in core IT jobs are significantly older. Some of the evidence for this finding is provided in the charts at the bottom of this page. The first shows that the share of degreed IT specialists working in "core" positions drops from 75 percent for those in their twenties to 50 percent for those around age 50 and less than 25 percent for those over age 60. The second chart shows that this pattern of employment is not typical of other people in the science and engineering workforce; the age structure of core IT workers peaks a full decade earlier than that of other types of technical people.

Indicators of supply and demand for qualified IT specialists will be considered in more detail in our final report. First, however, we will examine the roles that foreign-origin workers are playing in the industry, in the next paper in this series.

Degree Status	Workforce Status		Total
	Working in Core IT Job	Working Elsewhere	
IT Degree, Either Undergraduate or Graduate	458,559	264,988	723,547
No IT Degree, but Undergraduate IT Minor	53,974	62,453	116,427
Neither of the Above, but in S&E Workforce	602,548	10,593,681	11,196,229
Totals	1,115,081	10,921,122	12,036,203

Source: SESTAT. See citation in table, p. 2.



³Robert K. Weatherall, "Firms and Their Needs," in "The Strongest Market in Years for New Graduates," *ENGINEERS* Vol. 4, No. 2 (April, 1998), pp. 4-6.

⁴ *Help Wanted: The IT Workforce Gap at the Dawn of a New Century* (Arlington, VA: Information Technology Association of America, 1997), p. 39.

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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.

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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 activity 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 call 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 and 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
Years of Education, for:		
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.

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Assessing the Demand for Information Technology Workers

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 is our fourth and final report. Earlier papers in the series, all released in 1999, provide a general overview of the IT workforce, review the supply of persons with appropriate academic degrees, and furnish data on the employment of foreign-origin workers in IT jobs.

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.

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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; and to Mary Bowler, economist with BLS' Division of Labor Force Statistics, for time series data on employment and unemployment in core IT occupations.

November, 1999

According to much of what one hears in media reports and policy debates in the Congress, the United States never seems to have enough high tech workers. Warnings of shortages of engineers, scientists, and now information technology specialists have appeared regularly since the 1950's. Such concerns are understandable; technological strength is seen as a crucial ingredient of American economic prosperity. Other factors add to the continual pressure to maximize the country's supply of technical talent. Large labor pools help employers contain their payroll costs and improve the odds for a steady supply of occasional brilliant performers, the technical wizards whose contributions have been shown to be crucial. Training all of these specialists keeps academics busy; large academic establishments also contribute to American research and development capabilities, fueling the emergent technologies that keep this system going. For many, questioning this state of affairs is tantamount to arguing with success.

However, there is a problem: in all these years, there is no evidence that any serious shortages of technical professionals — engineers in the past, information technology specialists now — have ever occurred. To be sure, there have been ups and downs in supply and demand as normal business cycles of boom and recession affected general levels of employment, and as demographic trends influenced supplies of newly trained workers. In the early 1970's and again in the early 1990's, there were serious problems of weak demand for technical people. There have been obvious cases of "spot" shortages: scrambles for people with especially hot specialties, experience in particular industry sectors, or favored geographic locations. But on the national level, data on trends that reflect supply and demand for technical professionals have been mainly notable for their stability. This applies with special force to measures of pay, the best indicators of actual shortages of workers. If shortages exist, compensation should rise sharply as employers bid for scarce talent, but when adjustments are made for inflation, technical pay has remained remarkably consistent since the 1950's, even with allowances for such factors as bonuses and stock options. As this paper shows, this general picture of high tech employment trends seems to apply to information technology today just as it has to other kinds of technical professions in the past: spot shortages may exist, and strong demand can be seen for some kinds of people, but on the whole there is no compelling evidence to suggest a national shortage of IT workers, either now or in the near future.

To assess the nation's need for technical talent, it helps to start by understanding where we already are. The number of engineers, scientists, and other technical professionals in the United States has been growing rapidly for 60 years. At present, information technology includes the fastest growing occupations in the country.¹ Even the "Baby Bust" of the 1960's and 1970's, when annual numbers of live births dropped 25 percent, did not stop growth in the technology sector's share of all U.S. jobs, although the rate of growth did slow down. Now the numbers of college-age youth are rising again, which will fuel further increases in the share of the U.S. labor force that is composed of information technology workers and other high tech specialists. In short: the USA has a rapidly growing technical workforce, and that growth is going to accelerate. Thus the question is not whether the supply of high tech people is growing; rather, the issue is whether existing growth is sufficient to meet national interests. Industry says those interests are threatened by inadequate supplies of IT specialists.² Others dispute this claim.³

¹ See the first report in this series, *Core Occupations of the U.S. Information Technology Workforce* (January, 1999).

² See *Help Wanted: The IT Workforce Gap at the Dawn of a New Century and Help Wanted 1998: A Call for Collaborative Action for the New Millennium*, both from the Information Technology Association of America (ITAA; Arlington, Virginia; 1997 and 1998). A third ITAA report in this series is anticipated but has not been released at this writing.

³ See Norman Matloff, *Debunking the Myth of a Desperate Software Labor Shortage*, based on testimony April 21, 1998 to the U.S. House Judiciary Committee Subcommittee on Immigration, at <http://heather.cs.ucdavis.edu/itaa.html>. Also see his *High-Tech Trojan Horse: H1-B Visas and the Computer Industry* (Washington: Center for Immigration Studies, 1999).

Indicators of Demand

In early 1998, Burt Barnow of the Institute for Policy Studies at Johns Hopkins University, John Trutko of James Bell associates, and Robert Lerman of the Urban Institute released a paper, *Skill Mismatches and Worker Shortages: The Problem and Appropriate Responses*, which is both an outline of factors that need to be considered in assessing the demand for specific occupational specialists, and a case study of the labor market for IT workers.⁴ Barnow *et al.* identify a set of "general indicators of potential labor shortages within specific occupations":

Trends in Employment Levels. Increasing levels of employment suggest increases

in demand. Our first report showed that the higher-level core IT occupations — computer scientists, computer engineers, and systems analysts — grew from less than 300,000 workers in 1983 to over 1.5 million workers by the end of 1998. Growth for programmers was less rapid, but the numbers of those workers also increased during this 15-year period, from about 450,000 to over 600,000. This trend of growth has continued in the first three quarters of 1999.

Trends in Unemployment Rates. Increased levels of unemployment suggest weak demand. Unemployment among experienced IT workers has been rising since 1997. The levels of unemployment are still not especially high, at 2.1 percent in the most recent quarter. Even so, the increases in joblessness undermine any conclusion that the overall growth in all IT employment, noted above, might be a signal of serious shortages.

Trends in Earnings. Barnow *et al.* state "The rate of wage growth within an occupation relative to other occupations is often the clearest indicator of the existence of a shortage (at least over the short term). Rapidly rising wages within an occupation suggest that at least a temporary imbalance exists between the labor supply and the demand."⁵

Using data from the Bureau of Labor Statistics' Current Population Survey, Barnow and his colleagues found that during the ten years from 1988 through 1997, changes in the earnings of core IT workers were similar to those for all professionals and only marginally higher than those for the entire civilian labor force. If arguments are to rest solely on these CPS data (a widely trusted source of such statistics), then this is "striking evidence against a shortage of IT workers," as Barnow *et al.* observe.⁶

However, the CPS wage data do not agree with some other sources. Barnow *et al.* take note of several surveys that indicate both higher levels and greater growth in compensation, including studies from Wm. M. Mercer, Coopers and Lybrand, DeLoitte & Touche, and *Computerworld's* annual surveys. None of these sources is as respected as the federal Current Population Survey, but the consistency of their results does give one pause.⁷

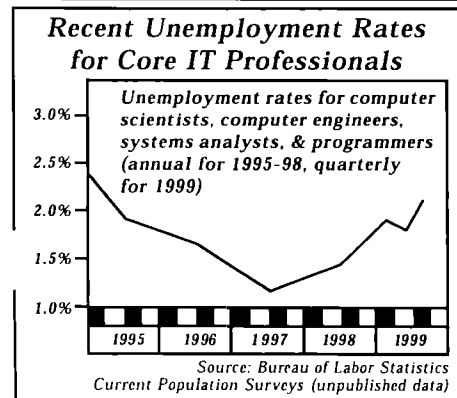
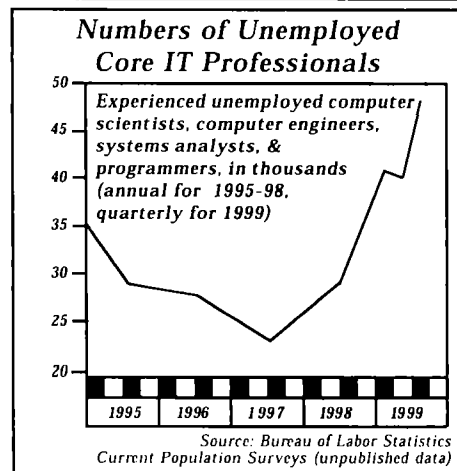
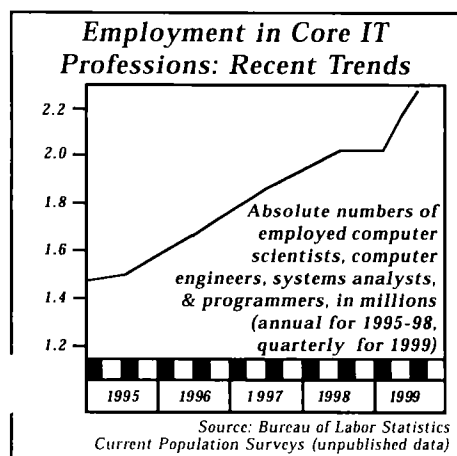
The U.S. branch of the Institute of Electrical and Electronics Engineers (IEEE-USA) has conducted biennial compensation surveys of its members for over a quarter of a century. The 1995, 1997, and 1999 editions of these surveys also show higher wage rates and stronger salary growth for IT specialists than does the CPS.⁸ Such differences are to be expected, since members of IEEE with specialties in computer software or hardware are an elite subset of IT workers.

IEEE's data include information on the effects of irregular contributions to income such as bonuses and stock options, two sources of gains in compensation that are often missed by traditional salary studies. Bonuses are one of the components of the primary incomes tracked by IEEE. Since 1994, their importance as contributors to the total income of IEEE's electrical and computer engineers has risen slightly, from 3.8 to 6.4 percent of overall earnings for those employed full time in their areas of professional competence. These increases are not large enough to make bonuses a major component of overall pay. Similar findings apply to the effects of income from profit sharing plans, which rose from 2.8 to 4.4 percent of total earnings.

Data on the impact of stock options are less easily assessed, since the value of options fluctuates from day to day, but IEEE does obtain estimates of the present value of options received during the previous calendar year. Both the share of IEEE members who reported options and the estimated value of those awards did rise between 1996, when 16.1 percent of these engineers and computer scientists reported options with a median value of \$7,100, and 1998, when 27.5 percent reported options with a median value of \$10,000. These values were highly skewed; about 10 percent of those who got options accounted for more than 80 percent of the aggregated value of all these rewards. Another ten percent viewed their options as worthless, estimating present values of zero. As IEEE's latest report puts it, "The median value of options [for all persons covered by its survey]... is zero, since over 70 percent got nothing at all from this source."⁹

Given that members of IEEE are among the most highly trained and valuable of all IT professionals, these results can be taken as a generous estimate of the effects of bonuses and stock options on the com-

⁴ Final report to the Office of the Assistant Secretary for Policy, U.S. Department of Labor (Washington: The Urban Institute, 1998).



⁵ *Ibid.*, p. 65.

⁶ *Ibid.*, p. 66.

⁷ *Ibid.*, pp. 68-70. The authors note that "It is not clear whether these surveys are broadly indicative of wage changes in the field of IT workers. In some instances, the wage surveys are conducted for groups that represent or advocate for a particular constituency (e.g., employers of IT workers, labor unions, or trade associations)." Another serious problem with many non-federal sources of salary data is that often they present only final results for particular detailed job titles (such as "senior software engineer"), geographic areas (e.g., the Southwest U.S.), or both, and do not provide information on the numbers of cases on which their results are based, so that it is not possible to aggregate data into meaningful national estimates for the IT industry as a whole.

⁸ IEEE U.S. Membership Salary & Fringe Benefit Survey 1995; IEEE U.S. Membership Salary & Fringe Benefit Survey 1997; IEEE-USA Salary & Fringe Benefit Survey, 1999-2000 Edition (Washington: IEEE-USA, 1995, 1997, 1999). The deficiencies of presentation and methodology noted previously do not apply to these biennial compensation surveys. As a technical society, IEEE may be an advocate, but its salary studies meet academic standards for completeness and rigor. For example, complete national summary data are provided, and statistics include full reporting for both numbers of cases and any nonresponses.

⁹ IEEE, 1999, *op. cit.*, p. 3-3.

pensation of IT workers in general. While not insignificant, these effects are not large. They have risen, but not by so much as to suggest major shortages of labor. The skewed distribution of the stock options suggests that their main function is to provide incentives for small numbers of people at the top.

Although both IEEE's statistics and other non-federal sources of data on the compensation of IT specialists have indicated strong demand, at least for those with exceptional skills, any trend of significant increases in pay may have slowed down even for the elite workers. *Computerworld's* latest survey, done during the summer of 1999, states that "The typical increase in information technology salaries has hovered between 4% and 5% for the second year in a row. Indeed, salaries for all but a few IT positions in 1998 and 1999 have remained remarkably flat."¹⁰ This outcome is consistent with IEEE's results, for that society's latest data reflect changes for 1997 as well as 1998—and *Computerworld* says that the largest increases came in 1997.

Other data also suggest that the period from 1995 through 1997 was a time of exceptionally strong demand in which IT compensation did improve. New information from the National Science Foundation's SESTAT database on scientists and engineers shows electrical engineering and computer science graduates with the lowest unemployment and underemployment rates and above average salary growth for this period, and electrical and computer engineers with the highest overall salaries.¹¹ However, the SESTAT statistics shed no light on any further developments after 1997.

Another factor that could obscure real increases in pay is shifts in the age structure of the IT workforce. Its rapid growth has been fueled by intensive recruitment of new graduates, both those with IT degrees and others. The more the IT labor force is comprised of relatively youthful workers, the lower its average pay.

To summarize: federal and non-federal sources of data on trends in pay do not yield consistent indicators of the demand for IT specialists in the recent past. It may have been very strong, but the only measure of current trends, *Computerworld's* 1999 survey, suggests that demand has moderated since 1997. One must give particular consideration to the CPS data used by Barnow *et al.*, because of all the different sources, only this one is known to cover all IT workers. Other surveys, such as those done by IEEE-USA, are more likely to apply to elites in the industry, where levels of compensation are higher and competition much fiercer than is the case for average IT workers in the nation as a whole.

Vacancies. Barnow *et al.* note that an alternative model of occupational short-

ages developed by Kenneth J. Arrow and William W. Capron "concludes that shortages will be characterized by vacancies."¹² Both reports on the IT workforce issued to date by the Information Technology Association of America (ITAA)¹³ cite vacancy rates to justify industry requests for increases in the use of temporary foreign labor and other interventions to boost supplies of qualified personnel.

ITAA's first report estimated a total of 191,000 vacancies, presumably for 1996 (the report is undated but was released in the Spring of 1997). Total core IT employment in 1996 was 1,654,000, so the ITAA data imply that one in every ten positions was vacant. A problem is that ITAA's findings were based on a sample survey of employers with a return rate of only 13.6 percent, rendering results suspect due to potential response bias.

The second ITAA study was similar. Response rates improved to 35.6 percent of the sampled employers, but weighted extrapolations of the data led to an estimate of well over 3.3 million core IT workers in the United States, nearly double the number counted by BLS at the time. Such results cast doubt on the credibility of other findings in this report, including the estimated number of vacancies (as in the first study, approximately one in ten).

Commenting on ITAA's first report, Barnow *et al.* note that a lack of any information about normal vacancy rates in the industry and the length of time that positions have been unfilled makes it difficult "to judge how serious this number of vacancies would be..." and they conclude that "the evidence presented is insufficient to judge whether an actual shortage exists."¹⁴ There are always some vacant positions, due to normal turnover of employees and the fact that newly created openings are initially vacant. It is also important to remember that IT is already the fastest growing employment sector in the United States. Since 1995, the number of core IT jobs (which precisely match the positions defined by ITAA) has grown 10 percent a year—that is, exactly at the level that industry vacancy figures suggest should be met. Where then is the problem?

¹² *Op. cit.*, p. 10.

¹³ *Op. cit.*

¹⁴ *Op. cit.*, pp. 41-43.

Decreases in the Supply of Labor. Another indicator of possible shortages cited by Barnow *et al.*, ITAA's first report raised this factor, pointing to declines between 1986 and 1994 in the production of new computer science graduates. But only a minority of IT professionals have CS degrees; business, math, natural and social science, and engineering majors are also commonly employed in IT jobs.¹⁵ Second, the drop in computer science enrollments has ended. The Taulbee surveys, conducted by the Computing Research Association, show that during 1996 and 1997 the number of computer science majors "effectively doubled,"¹⁶ and the trend continues, reinforced by the end of the "Baby Bust" effect on university enrollments in general: for the first time in a decade, colleges are seeing rising numbers of high school graduates.

This is not all. There are at least three additional sources of labor supply for the IT industry. In 1998, employers convinced the Congress to expand the numbers of foreign workers admitted each year with temporary H-1B visas for up to six years of professional employment. The revised ceiling of 115,000 new admissions a year is still viewed by some employers as an insufficient response to their needs. Despite the increase, the cap on the number of admissions continues to be reached well before each fiscal year ends, leading to an "annual foreign-worker hiring binge"¹⁷ as IT companies scramble not just for new people but also to catch up backlogs from preceding years. Other industries also make use of H-1B labor, so the number of these workers actually available to work for IT employers is less than the ceiling total. As a result, several members of Congress have announced intentions to introduce legislation to further increase the availability of foreign workers for IT jobs and to attempt to reduce problems of fraud in the program by screening to restrict entrants to people with advanced educations and substantial pay.

¹⁵ *The Production of U.S. Degrees in Information Technology Disciplines* (January, 1999).

¹⁶ P. Freeman & Wm. Aspray, *The Supply of Information Technology Workers in the United States* (Washington: Computing Research Association, 1999), p. 84.

¹⁷ Dan Gillmor, "You can have a say about H-1B visas," *San Jose Mercury News*, September 20, 1999.

Selected Indicators of Recent Trends in IT Wage Rates

Occupational Group	Annual Average Rise in Median Earnings	Source
Computer Scientists & Systems Analysts	3.5%	Barnow <i>et al.</i> (op. cit.), using CPS data for 1988 to 1997
Computer Programmers	4.0	
All Professional Occupations	3.4	
Entire Civilian Labor Force	3.0	
Fulltime EE's With Computer Hardware/Software Specialties	6.0	IEEE-USA Salary & Fringe Benefit Surveys, 1995-1999
"All but a few IT Positions"	4.0-5.0	Computerworld Salary Surveys, 1998 and 1999

¹⁰ "Return to Sanity," *Computerworld* (September 6, 1999).

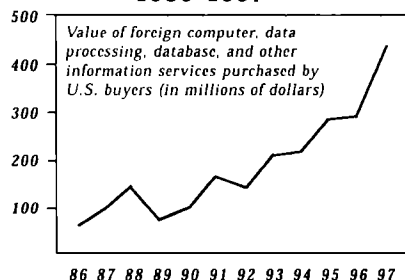
¹¹ Personal communication, from Michael Finn of the Oak Ridge Institute for Science & Engineering.

The H-1B program is controversial. Some American IT specialists believe temporary foreign workers displace U.S. citizens, that companies may see H-1B's as indentured servants who must depend on the goodwill of their employers in order to remain in the United States, and that the practice helps employers hold down prevailing wages. Other observers are convinced that U.S. technology has greatly benefited from contributions of immigrants, that the nation should welcome new talent, and that employers need access to the "best and brightest." All these claims, pro and con, have some basis in fact. Many cases of displacement have been documented, and some employers are known to view foreign talent as cheap labor. At the same time, the contributions of immigrants, both temporary workers and those who have gone on to become citizens, to American technology is unquestionable, and there is little doubt that many H-1B workers are very talented people. After all, most come to the attention of U.S. employers because they are already here, pursuing advanced degrees at American universities.¹⁸

H-1B workers are not the only kind of foreign talent working in the U.S. There are other visa categories for temporary workers, including the "L" program for foreign employees of firms doing business in the United States. Employers do not need to bring foreigners to this country in order to make some use of their skills. Another alternative source of supply for IT specialists is outsourcing of work to shops in India, Russia, and elsewhere. A measure of the magnitude of growth in outsourcing IT work to foreign job shops is provided by import statistics from the Department of Commerce. The dollar value of American purchases of offshore computer, data processing, database, and other information services increased nearly eightfold in the eleven year period between 1986 and 1997, to \$434 million. This level of work is especially impressive when one notes that the cost of using the services of people with Ph.D's in electrical engineering in India is about a tenth of this cost in the USA.

¹⁸ For more information, see the third paper in this series, *Foreign-Origin Persons in the U.S. Information Technology Workforce* (March, 1999).

Imports of IT Services, 1986-1997



Source: Private Service Transactions by Type, 1986-97. Bureau of Economic Analysis, U.S. Dept. of Commerce (<http://www.bea.doc.gov/ai/1098srv/table1.htm>)

Like the use of foreign temporary workers, outsourcing is not universally viewed as desirable. Some observers are concerned that outsourcing may undermine U.S. capacities. By offsetting domestic shortages, demand for the internal supply of people is weakened.

A third broad source of additional IT labor consists of underutilized workers in the domestic labor force. As was noted in our first report, over a third of the people trained in IT professions are not employed in these fields. To be sure, some of these persons work in closely allied jobs — e.g., professors of computer science or managers of IT companies (either status is counted outside the IT specialties *per se*). And all professions include graduates who do not put their training to work. Some change careers, some never intended to practice in the first place, and some are simply unsuited for a field or for employment generally. Even so, more than a quarter of a million persons with degrees in IT disciplines were not employed in those fields in 1995.¹⁹ Some of those people might be persuaded to return to the industry.

A problem in discussions of the IT job market is the tendency to treat it as a single monolithic entity when in fact it varies enormously by region, types of firms, and types of job candidates. Companies that *create new hardware and software* are the most glamorous players, concentrated in areas like Seattle, Boston, and the Silicon Valley. This end of the industry is fiercely competitive — the term "carnivores" has been used, with pride²⁰ — and it seeks workers who are the stars of the profession. It is often assumed that conditions in this segment of the industry apply to all, but they do not. For example, Anderson Consulting considers a much wider range of employment candidates than does Microsoft.²¹ Anderson, a very large employer of IT talent, is in the business of *applying hardware and software to solve its clients' problems* — a larger, less visible, more mature segment of the industry.

Conclusions and Some Puzzles

In summary, none of the possible signs of an inadequate supply of IT workers provides unambiguous evidence that there are not enough people in the field, and several indicators — rising numbers of experienced unemployed workers, the "flat" compensation results reported by *Computerworld*, increasing enrollments in computer science — suggest that if anything, pressures of demand on the available supply may have eased somewhat during the past year. Increased use of foreign talent, both in the U.S. and in offshore job shops, reinforces this

judgment, adding to the range of options available to people who need IT skills.

This does not rule out less general kinds of difficulties in the IT job market, both for employers and for job candidates. It may seem contradictory, but we suggest that (1) there is no general national shortage of workers, (2) many employers still can't find the people they seek, and (3) some persons with IT training and experience have difficulty finding work. How can this be?

One answer may be that there are signs of a strong preference for recent graduates in the IT job market. Young workers have been trained in current technology, are probably more likely than others to be willing to work the long hours and give the total commitment that some IT employers want, and they cost less. The thirst for such people helps to explain the strong industry interest in H-1B's, who account for large shares of the pool of recent graduates, especially at the MS and PhD levels.

Data on age in the second report in this series show that core IT professionals are much younger than those in other technical professions.²² Freeman and Aspray discuss the issue: "There is a common perception that information technology is an occupation for younger workers. We all have the image of the young programmer staying awake on massive doses of caffeine while undertaking a thirty-six hour programming session. There is some truth to this image..."²³

The appeal of youthful workers is explained in part by the short life cycle of information technology. As Freeman and Aspray observe, "This rapid turnover in technology makes it imperative that IT workers adapt to new technologies and new products... they must continuously work at keeping their skills and knowledge up to date or risk becoming obsolete and unemployable."²⁴ Freeman and Aspray do not explain how to do this while putting in 36-hour days.

When heavy emphasis is placed on training and experience that is both very specific and very recent, those who lack these credentials may encounter serious problems finding work, even if they have amassed lengthy records of success in the past. This raises at least two questions. First, are employers missing an opportunity to make better use of candidates who are not so young? And if it is commonplace for people in IT — including foreign as well as domestic workers — to become dated and therefore less employable in the profession, what steps if any should be taken to deal with this situation? We have no ready answers to these questions, only a belief that they need to be asked. This, and not a more general shortage of talent, is a critical challenge that faces information technology today.

¹⁹ *The Production of U.S. Degrees in Information Technology Disciplines* (op. cit.).

²⁰ Gary Rivlin, *The Plot to Get Bill Gates* (New York: Random House, 1999), p. 227.

²¹ Robert K. Weatherall, "Firms and Their Needs" in "The Placement of New Graduates," *Engineers* Vol. 4, No. 2 (April, 1998), p. 4. Freeman and Aspray, op. cit., also discuss such differences in the industry.

²² *The Production of U.S. Degrees...* (op. cit.).

²³ Op. cit., p. 115.

²⁴ *Ibid.*, p. 40.

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POLICY RECOMMENDATIONS OF THE TRANSATLANTIC LEARNING COMMUNITY WORKGROUP ON MIGRATION

During the past two decades, the countries of Europe and North America have seen record levels of immigration. The experience has been near universal, and no receiving country has been fully prepared for the consequences. Some States, such as Germany, have emerged as new migration loci, drawing millions to their borders, first through labor recruitment policies and then family reunification and asylum programs. At the same time, traditional emigration countries, such as Italy and Ireland, have seen their own populations return as well as new immigrants arrive from distant lands.

Despite the widespread prevalence of immigration today, it has not generally received sustained attention from policy-makers and opinion leaders in Europe and North America. Rather, the response has been episodic and, too often, generated by the crisis of the moment. Moreover, since immigration deals with emotionally-charged issues that touch the core of who we are and what we believe as nations, the debate on immigration has tended to be polarized, with the extremes often dominating the discourse. The resulting policies too often proved themselves unable to deal with the realities of migration today. In short, episodic policy attention is too little, and generally occurs too late, for effective management of what has become the sustained phenomenon of international migration.

There are signs, however, that this situation may be changing. The recent European Union summit in Tampere called for further harmonization of policies as well as improved management of migration flows. The European leaders also reiterated the need for their countries to work more effectively with source countries of immigration to reduce emigration pressures while, at the same time, attending to the integration of legal immigrants into European society.

Launched and supported by the Bertelsmann Stiftung, the Center for Applied Policy Research and the German Marshall Fund of the United States, the TLC-Migration Workgroup has sought to identify and promote the exchange of best practices in managing

immigration and integration of immigrants in Europe and North America. Co-chaired by Philip Martin and Susan Martin (U.S.) and Patrick Weil and Jonas Widgren (Europe), the migration workgroup includes opinion leaders from academia, think tanks, government, business, community based organizations, and the media (Appendix I includes a more detailed description of TLC and a full list of participants).

The recommendations that follow derive from two years of site visits and discussions. Members visited Miami, Amsterdam, El Paso, Juarez, Lyon, Casablanca, Rabat, Vienna and Munich to identify and discuss best practices in immigration and integration policy. The recommendations made in this report were discussed at length. This report, drafted by the co-chairs, reflects these discussions, although individual members of the TLC Migration Workgroup do not necessarily subscribe to each specific recommendation.

GUIDING PRINCIPLES

The TLC Migration Workgroup calls for greater harmonization of immigration policy in North America and Europe. Underlying the specific recommendations that follow are three principal conclusions about the nature of immigration and the responsibilities of states to manage population movements:

- **Immigration policies must be comprehensive and transparent, recognizing that international migration is a continuing phenomenon affecting all advanced industrial democracies.** Governments should clearly define who may be admitted to their territory, and immigration policies should then seek to facilitate the admission of those legally authorized to enter while deterring the entry of those without such authorization. States that continue to adhere to the premise that they are not immigration countries or seek zero immigration, despite strong evidence to the contrary, will inevitably fail to manage this process.

- **Countries cannot manage immigration through unilateral policies alone.** By definition, international migration affects at least two states, the source and destination countries, and often involves transit through other states. Effective management requires cooperation and coordination with other receiving states and with the source countries of migration.
- **Having admitted large numbers of immigrants during the past generation, the countries of Europe and North America have an obligation to promote the long-term economic, social and civic integration of their new residents.** Democracies cannot long function with significant populations who live in the marginal situations that characterize many immigrants.

RECOMMENDATIONS FOR IMMIGRATION POLICIES

LEGAL ADMISSIONS

There is an increasing convergence of migration issues to be addressed by western States, and an increasing convergence of solutions adopted. Governments should continue to strive to harmonize immigration policies within Europe and across the Atlantic. Greater transparency in immigration policy will ensure greater consistency and credibility. Harmonization in collection of data and statistics on immigrants, using agreed upon definitions and categories, will facilitate transparency and consistency.

Family Reunification. Family reunification is the cornerstone of immigration to most countries in Europe and North America. Governments should give priority to the reunification of nuclear families without setting specific numerical limits/quotas on these admissions. Eligibility should extend to the nuclear families of citizens and legal immigrants alike. Family reunification of minor children should take place as quickly as possible.

Asylum. Continued adherence to the principles of the 1951 Convention Relating to the Status of Refugees should be the cornerstone of refugee policy. Withdrawal of European

and North American States from the 1951 Convention system would be a very dangerous development. Disengagement from the Convention would undermine the international framework for protecting and assisting refugees worldwide.

European and North American governments should seek further harmonization of the substantive criteria for asylum. Harmonization should not, however, result in a lowering of standards for granting asylum. To protect bonafide refugees while deterring abuse of the asylum system, governments should:

- enhance exchange of information on conditions in countries of origin;
- ensure that asylum decisions are taken by competent authorities and asylum seekers have access to legal assistance to prepare for interviews;
- increase the timeliness and efficiency of asylum procedures, which will benefit bona fide refugees otherwise kept in limbo as well as governments aiming to discourage abuse in the asylum system;
- reduce use of detention for asylum seekers who meet minimum criteria (e.g., manifestly unfounded or credible fear tests) and are not a threat to public safety;
- adopt procedures through which those with a well-founded fear of persecution may request admission to a country of destination while they are still within their countries of origin; and
- improve the capacity to repatriate asylum seekers whose claims to refugee or other humanitarian status are refused.

Others in Need of Protection. Repeatedly during the 1990s, governments have been faced with mass inflows of persons fleeing dangerous, even life threatening situations. It is highly likely that mass migration emergencies will occur in the 21st century, necessitating the development of more consistent policies for handling these population movements. Harmonization of temporary protection policies during mass influxes is a high priority for policy makers in Europe and North America. Harmonization should include the following elements:

- Governments may (but have no obligation) to defer decisions on individual status for a short and reasonable period in the case of mass influx.

- If the emergency causing the mass influx continues beyond the short and reasonable period, an individual status determination procedure should be instituted. Asylum should be granted to persons meeting the Convention criteria, and a complementary status should be granted to those whose return would otherwise endanger them.

Governments should develop mechanisms through which the financial costs of providing temporary protection are shared. In addition, the credibility of temporary protection requires concerted efforts to repatriate those granted this status as soon as conditions in the country of origin permit safe and orderly return. Provisions should be made, however, for alternate solutions (permanent settlement in the host country or resettlement in a third country) if conditions preventing repatriation prevail for more than a determined period (e.g., five to seven years).

High-Skilled Migration. Highly skilled migrants include groups as diverse as academics and other scientists, students, business travelers, high-level managers and technicians, artists, and athletes. Some may arrive with no intention to settle in the receiving country, while others may seek an opportunity to gain permanent immigration status. Governments must enhance the benefits of high-skilled migration for both countries of origin and destination. Policies regulating admission of high skilled immigrants should provide incentives to foreign students and workers who remain within Europe and North America to invest in their home countries. For example, foreign workers from developing countries should be able to take assignments in their home country without jeopardizing the ability to return to their new country.

Admission policies should also balance the interest of business in having access to a global labor market and the interest of domestic workers in gaining protection against unfair competition from foreign workers.

Lesser-Skilled Migration. Many of the countries of Europe and North America permit admission of agricultural and other lesser skilled workers, particularly for employment in seasonal jobs. Seasonal worker programs should be implemented only under certain conditions:

- there is an adequate level of control over unauthorized entry and work;
- incentives are in place for employers to hire domestic workers or take other actions, such as mechanization, to reduce dependence on foreign workers; and
- bilateral agreements enlist the cooperation of source countries in curbing illegal movements and readmitting their nationals.

CONTROL POLICIES

A credible immigration policy necessitates controls over entry. Uncontrolled unauthorized migration undermines respect for the rule of law and serves as a barrier to adoption of legal admissions policies. The control mechanisms must be consistent, however, with the values embraced by liberal democracies.

Visa and Border Control Policies. Governments should continue to give priority to visa and border control policies that facilitate legal admissions while deterring unauthorized entry. Policies needed to help ensure that visa requirements and border control balance the twin goals of facilitation and control include:

- formal, independent review of visa decisions, particularly when a citizen, resident legal immigrant, or domestic business is seriously affected by a negative decision;
- coordination and cooperation between the European and North American visa and border control information systems;
- appeals processes for persons whose names appear without due cause on information systems used to establish eligibility for admission (either in visa issuance or border controls); and
- harmonization of the rules implemented to sanction carriers who violate their immigration related responsibilities (harmonization of the amount of the fines, of potential imprisonment and of the payment of the costs related to repatriation of those without permission to enter).

Anti-smuggling/Anti-trafficking Activities. Smuggling and trafficking in aliens has become a multi-billion dollar industry that impedes control over unauthorized entry, leads to

exploitation of migrants and endangers their lives and safety. There is urgent need for enhanced cooperation of European and North American governments in combating these operations, including: law enforcement activities involving police and immigration authorities of multiple countries; intelligence gathering; public education campaigns to warn migrants of the risks incurred; and protection of the rights and safety of smuggled and trafficked migrants.

Sanctions against Employers. Jobs continue to be a magnet for unauthorized migration to many North American and European countries. Governments should assist bonafide employers to determine if applicants are authorized to work by: 1) specifying a limited number of counterfeit-resistant identification documents to be used to establish work authorization, and 2) facilitating employer access, under appropriate safeguards, to information systems that can be used to verify the authenticity of the specified documents. The most effective sanctions target enforcement against businesses that purposefully hire unauthorized migrants, with special attention to those who violate immigration as well as labor laws.

Detention Policies. Governments faced with the apprehension of unauthorized migrants often detain them pending removal from the country. Governments should seek to harmonize administrative detention policies. Harmonization could include the following components: 1) prioritization of those to be detained, with top priority given to detaining those who are a threat to public safety, recidivists who have demonstrated that they are likely to abscond if released, and persons who have already been ordered deported and can be removed within a reasonably short time; and 2) imposition of reasonable time limits on detention.

RECOMMENDATIONS FOR RELATIONS WITH SENDING COUNTRIES

Governments should continue to foster bilateral and multilateral cooperation on the management of international migration. Because of the complex factors within both source and destination countries that motivate and sustain migration, cooperation in the management of international migration makes a great deal of sense. Bilateral and regional

forums, such as the Regional Migration Conference (Puebla Group) and the EuroMed conferences, help sustain discussion of migration issues of mutual concern and promote the development of migration management strategies that serve mutual interests.

Migration, Trade and Development. Governments should link trade and migration discussions explicitly, recognizing that closer cooperation on economic issues can also lay the basis for cooperation on migration. They should also use closer economic integration to create forums to discuss migration issues. Governments should target efforts to reduce emigration from particular geographic areas within source countries.

Remittances of about \$75 billion annually are a major source of foreign currency in countries from Algeria to Yugoslavia. Unlike earnings from trade and government-to-government aid, remittances typically flow directly to emigration areas. Governments should seek to maximize the development payoff of remittances and migrant returns, for example, by fostering investments in projects that will create jobs and make migration unnecessary.

Managing Shared Land Borders. Many industrial democracies share land borders with emigration and transit neighbors: the US with Mexico and Germany and Austria with Poland, the Czech Republic, and Hungary. Managing migration across shared land borders must facilitate legal crossings (that is, for trade, investment, tourism, family visits and consumer activities) while deterring unauthorized entry. A number of practices can help facilitate legal and prevent unauthorized entries across shared borders:

- issuing border crossing cards that serve as multiple entry visas (for example, up to 25 miles and 72 hours inside the US) for residents of border areas who are most likely to commute;
- cooperating with neighboring countries to develop Dedicated Commuter Lanes for frequent border crossers;
- increasing staffing at border crossing points to reduce waits for entry;
- adding agents, fences, lights and other devices to deter unauthorized entries between ports of entry;

- promoting cooperative policing in border areas, as occurs with German and Polish Border Patrol agents volunteering to patrol jointly along the German-Polish border; and
- permitting visa-free entry for border residents, linked to agreements that the country sharing the border will cooperate in preventing the entry of third country nationals across the shared border.

Neighboring countries should institute regular consultations involving all levels of government as well as the private sector in border communities to discuss ways to foster cooperation and to make explicit any linkages between trade, aid, and migration. In the El Paso-Juarez area, the respect and cooperation expressed by Mexican and U.S. officials in the Border Mechanism Liaison has greatly improved migration management. German and Polish border patrol agencies meet regularly to share information on smugglers and routes.

RECOMMENDATIONS FOR THE ECONOMIC, CIVIC AND SOCIAL INTEGRATION OF IMMIGRANTS

All European and North American countries have sizeable foreign-born populations who are likely to remain permanently in their midst. While many immigrants are doing well economically, have become citizens and are socially integrated into their new societies, far too many immigrants have not been integrated in any of these senses. Unemployment and underemployment is endemic, many immigrants who want to naturalize find barriers to citizenship, and residential and social segregation continues unabated in many communities.

There is urgent need for North American and European countries to take action to address barriers to full economic, social and civic incorporation of legal immigrants residing in their communities. Although other barriers to full integration exist, discrimination against foreigners remains a major problem that must be addressed.

Economic Integration. Governments and the private sector should take immediate action to improve the economic integration of immigrants in Europe and North America. The following strategies help immigrants overcome the barriers to economic integration.

Examples of such approaches can be found on both sides of the Atlantic, attesting to their broad applicability.

- literacy, host country language acquisition, and basic skills upgrading for both new arrivals and immigrants already residing in host countries. Special attention should be given to the children of immigrants to help ensure that educational barriers do not persist into the second and third generation;
- programs to stimulate immigrant business development and help immigrant entrepreneurs to do more effective planning, comply with labor, tax, and other business requirements, identify sources of capital and otherwise take the steps needed to operate successful enterprises;
- efforts to combat racism and discrimination at the workplace and encourage businesses to make positive efforts to recruit immigrant workers; and
- eliminating unnecessary and inappropriate restrictions that limit certain jobs to citizens.

Civic Incorporation. European and North American countries should take immediate steps to encourage naturalization by:

- reducing legal and administrative barriers to citizenship; and
- facilitating citizenship for children born to immigrants in host countries.

Beyond facilitating citizenship, countries should adopt programs to help empower new citizens to participate fully in the civic, social, and economic life of their host societies.

Social and Community Relations. National authorities should work closely with local communities to facilitate the social integration of immigrants and to reduce community tensions that may arise. Strategies used on both sides of the Atlantic to improve community relations include:

- educational programs to promote tolerance;
- programs to orient new immigrants to accepted ways of life in the host society;
- conflict mediation programs;
- vigorous prosecution of hate crimes and similar offenses committed against immigrants because of their race, nationality or religion;
- programs to build positive relations between immigrants and the police; and

- reduction in discrimination against immigrants.

Exchange of Best Integration Practices. Governments should expand opportunities to share their experiences in facilitating the economic, civic and social integration of immigrants.

Phil Martin Susan Martin Patrick Weil Jonas Widgren

About the Transatlantic Learning Community

The end of the cold war has dramatically changed the framework of transatlantic relations. The disappearance of the external threat to free societies has brought about a substantial shift of the political and societal focus towards issues of domestic interest such as migration, unemployment, rising crime, crises of the respective welfare systems, and so forth. The Transatlantic Learning Community (TLC) is designed to respond to this change of agenda on both sides of the Atlantic. TLC is a project of the Bertelsmann Foundation, the Center for Applied Policy Research and the German Marshall Fund of the United States. It brings together those who work with pressing issues on a daily basis in order to help them learn from each other's approaches and experiences. Such transatlantic exchange enables policy makers and opinion leaders to improve their practices and to establish a network for continuing transatlantic cooperation.

Immigration policy has been one of the first issues on TLC's agenda. During the past two years, European and North American experts have met to review current immigration policies and procedures, discuss issues of common transatlantic concern and identify best practices that can be replicated on both sides of the Atlantic. They found many promising approaches for transatlantic exchange, but they also identified policy areas in which no best practices currently exist. Where no best practices could be found, the group proposes options they believe will improve policies and practices.

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