



NORTH-HOLLAND

Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

SCIENCE @ DIRECT®

Technological Forecasting & Social Change  
xx (2004) xxx–xxx

---



---

**Technological  
Forecasting and  
Social Change**


---



---

# U.S. immigration regulations and India's information technology industry

Ron Hira

*Rochester Institute of Technology, 92 Lomb Memorial Drive, Rochester, NY 14623, USA*

Received 23 June 2003; received in revised form 16 January 2004; accepted 23 January 2004

## Abstract

The export-led growth of India's information technology (IT) industry has been nothing short of phenomenal over the past half-dozen years. Other studies have provided a number of explanations for the growth. This paper proposes that a significant factor has been overlooked or understated in prior explanations. Specifically, the Indian IT industry has utilized U.S. immigration regulations for competitive advantage to accelerate its growth. The importance of this factor is estimated through quantitative data analysis at the macro and firm levels. The analysis helps to explain why India's IT industry grew while that of other developing countries, with similar human capital resources and wage rates, did not. The U.S. Congress is currently debating U.S. immigration policies and may change them in the near future. Any changes will have significant effects on the future growth pattern of the Indian IT industry. Many developing countries have recognized India's success, and policymakers in those countries are implementing strategies to replicate it. The results from this study may help those policymakers better understand a key factor of India's success in exporting IT.

© 2004 Published by Elsevier Inc.

*Keywords:* Information technology; Globalization; Immigration

## 1. Introduction and objective

Information Technology (IT) industries can be an important source of economic growth and development for developing countries. The Indian software industry, which has been

---

*E-mail address:* [rhira@mail.rit.edu](mailto:rhira@mail.rit.edu) (R. Hira).

successful at exporting IT services, is the exemplar for developing countries. NASSCOM, the Indian software services industry association, estimates that the Indian IT industry has grown nearly eightfold from 1994 to 2001, with revenues in 2001 of approximately US\$13.5 billion and 2.87% share of India's GDP [1].

There are many explanations for India's recent success in IT: economic liberalization, the country's pool of technically trained workers willing to work for low wages, good English skills of those workers, a mindset that is oriented toward intellectual abstraction, low capital requirements for entry into software services, as well as many others [2,3]. Many of these factors help to explain what contributed to the rapid IT expansion in the past half-dozen years. However, most of the factors are not unique to India. For example, many Central and Eastern European countries have similar pools of technically capable workers, and they liberalized their economies at approximately the same time as India did. Therefore, why has India been so much more successful than other countries, such as Romania or Russia? Do the factors described in the literature adequately explain differences in success rates?

One factor often overlooked in explaining Indian IT firms' advantage in the U.S. marketplace is their ability to leverage U.S. immigration regulations for competitive advantage. Indian IT firms have adopted business practices based on those regulations earlier and at a greater scale than have competitors from other countries. In fact, the business models for many Indian IT firms depend on bringing foreign personnel into the United States on temporary work visas for extended periods. This practice mimicked the U.S.-based companies, which had adopted it in the early 1990s. Many of these U.S.-based companies, such as Syntel, Mastech (now known as IGate), Intelligroup and Complete Business Solutions, were operated by people of Indian origin. While, Arora et al. [2] and Heeks [4] have discussed the importance of onsite labor for the Indian IT industry, they do not measure its impact on the development of the industry.

The hypothesis of this paper is that the Indian IT firms' use of immigration regulations is an important explanatory factor in their success. The next section of the article will describe the immigration regulations that are relevant to the IT industry and present macrolevel data of temporary workers by country of origin. This analysis shows that the majority of high-skilled temporary workers in the United States come from India, and many work in firms, known as body shops, that supply software personnel to customers. The third section drills down to the firm level and quantifies how much the leading Indian IT firms depend on the regulations for their business. Firm-level financial data are used to estimate the revenue and earnings that temporary workers generate for leading Indian-based IT firms. The fourth section describes how the slowdown in the U.S. IT market might affect the Indian IT firms. The concluding section describes the policy implications and their potential impact on the Indian IT industry.

## 2. U.S. Immigration regulations and India's IT worker migration

The United States employs a variety of visa categories to admit foreigners for business, pleasure, study, work, or immigration. A basic introduction to work visa categories is presented first. Next, an analysis of longitudinal data for key visas shows that workers of Indian origin have been the primary beneficiaries of temporary worker visas.

## 2.1. Visa categories

Foreigners entering the United States must apply for and be granted a visa by the Bureau of Citizenship and Immigration Services (BCIS), formerly the Immigration and Naturalization Service. The BCIS is an agency in the newly created Department of Homeland Security. The purpose of a foreigner's visit dictates the type of visa issued. Foreigners must also meet certain criteria to qualify for the visa. The visa categories most important to the IT industry are described below.

EB is an employment-based visa for permanent immigration to the United States and has an annual cap of 140,000. Employers that wish to sponsor an employee must ensure that qualified Americans are not available to fill these positions and that immigrant admissions will not adversely affect the wages and working conditions of U.S. workers. The Department of Labor (DoL) reviews the applications for compliance.

O is an extraordinary ability visa reserved for foreigners who demonstrate extraordinary accomplishments. The BCIS generally consults with employee organizations or peer groups in the United States to verify the petitioner's claims. There is no significant advantage for the IT industry to use the O visa instead of others described below.

TN is the North American Free Trade Agreement (NAFTA) Professional visa that allows Canadian and Mexican professionals to work temporarily in America. IT employers recruiting Canadian and Mexican technical talent may find the TN visas more flexible to use than other categories.

H-1B is a temporary worker visa issued to employers to hire specialty occupation workers. A specialty occupation is a position that requires the theoretical and practical application of highly specialized knowledge and skills and, at least, a bachelor's degree. The H-1B visa has been the category most closely linked to the IT industry; therefore, a more detailed explanation of its visa approval process is described below.

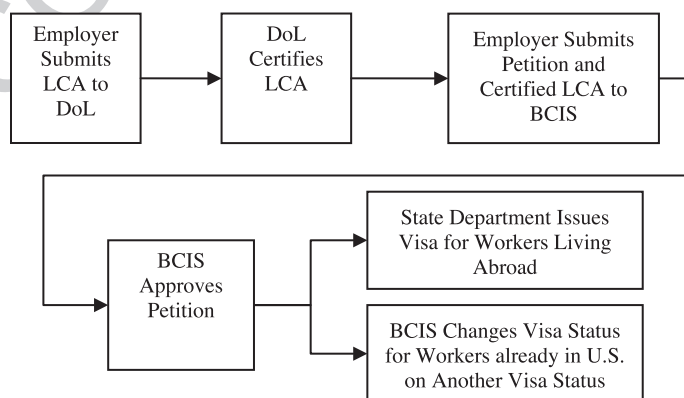


Fig. 1. The H-1B visa process.

Fig. 1 shows the H-1B visa process. An employer submits a labor condition application (LCA) to the DoL. The LCA requires a number of attestations by the employer including that it is paying the “prevailing wage” for the position. Once the DoL approves the LCA, the prospective employer petitions the BCIS to admit a specific worker. When the BCIS approves the petition, the foreigner can file for an H-1B visa at the nearest U.S. consulate if he or she is living abroad, or file a change of status if he or she is already in the United States under another visa category. Specialty occupation visas are granted for a maximum of three years, but can be extended for another three years. However, visa holders can only work for a petitioning employer.

The maximum number of new H-1B visas had an annual cap of 65,000 from fiscal years (FY) 1991–1998. For FY 1999 and 2000, it was raised to 115,000 and, for FY 2001–2003, it was raised to 195,000. For FY 2004, it will revert to 65,000.

L-1 is an intracompany transfer visa used by multinational companies to move employees to the United States for temporary assignments. The employees are required to be executives, managers, or in positions that require specialized knowledge. Executives and managers are able to stay up to seven years, while specialized knowledge workers can stay up to five. There is no annual cap for L-1 visas and no prevailing wage requirement. These features may make the L-1 more attractive than the H-1B. Some Indian IT firms have increased their use of the L-1 more rapidly than the H-1B.

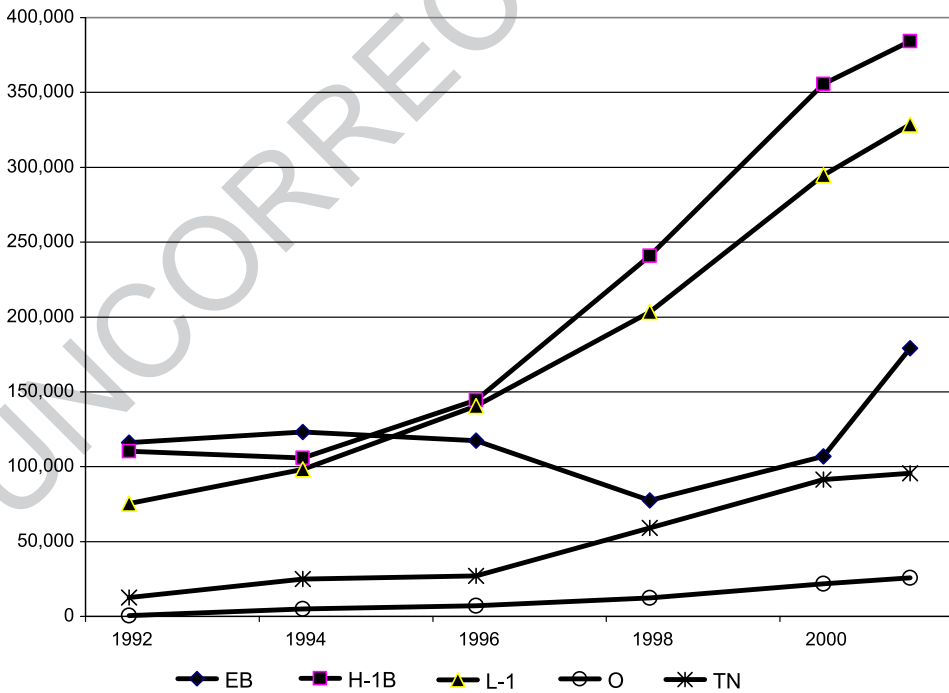


Fig. 2. Admissions by visa categories.

Table 1

Top 5 H-1B occupations shift between 1995 and 1998

1995		1998	
Top 5 occupations	Percent of H-1Bs (%)	Top 5 occupations	Percent of H-1Bs (%)
Therapists	54	Computer specialists	57
Computer specialists	25	Therapists	14
University faculty	2	Accountants	7
Physicians	2	Electrical engineers	3
Accountants	2	Architects	2

## 2.2. Visa category use

Fig. 2 shows that visa admissions have generally increased over the past decade. The H-1B, L-1, and EB are most important for the Indian IT industry. The data in Fig. 2 show that in 1996, the number of admissions of H-1B and L-1 visas surpassed the EB admissions and continued to rise substantially. The TN only applies to Canada and Mexico, and the O visas, which are more difficult to obtain, do not provide any additional benefits for the employer. However, the TN visa may become more important, as Indian IT firms establish a greater presence in North America and because the U.S. Congress allowed the H-1B cap to drop to 65,000.

Table 1 shows that the occupational mix of H-1B beneficiaries shifted from health care to IT between 1995 and 1998. Paralleling the shift in occupational mix, Table 2 shows that the top 10 employers requesting LCAs shifted from health care to IT during the same timeframe. There are a few large employers on the list in 1998, such as Oracle, Lucent, and Motorola, but the list also includes software body shops such as Tata Consultancy Services (TCS) and Mastech. TCS is an Indian-based IT firm that was one of the first to penetrate the U.S. market. Two of the firms listed in the 1995 column, Complete Business Solutions (now known as Covansys) and Mastech (now known as IGate), are U.S.-based IT services companies founded by entrepreneurs of Indian origin, providing a strong indicator that Indian Diaspora

Table 2

Top H-1B LCA requestors in 1995 vs. 1998

Rank	1995 Top H-1B LCA requestors	1998 Top H-1B LCA requestors
1	Premier Health Staff	Mastech
2	Tata Consultancy Svcs	Tata Consultancy Svcs
3	Professional Therapy Staffing	ComputerPeople
4	University of California	Oracle
5	Complete Business Solutions	Price Waterhouse Coopers LLP
6	Mastech	Lucent Technologies
7	Harvard University	Motorola
8	Sunbelt Physical Therapy	Syntel
9	Allied Rehabilitation Mgmt	Intelligroup
10	University of Texas	Comsys Technical Svcs

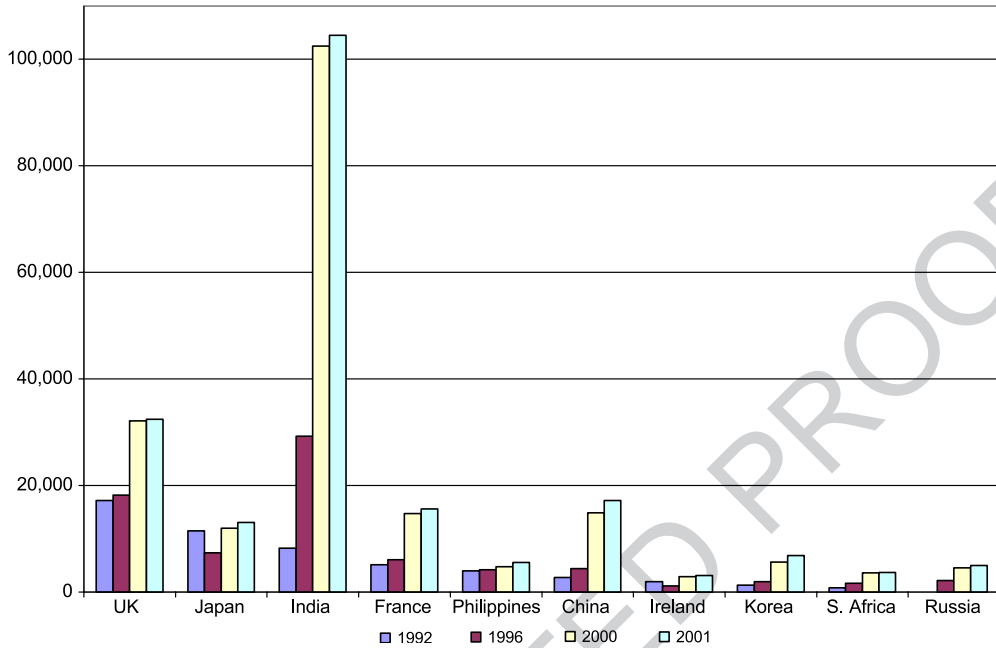


Fig. 3. H-1B admissions by country from 1992 to 2001.

were some of the first movers in this business model. By 1998, three such companies, Mastech, Syntel, and Intelligroup, were part of the top 10. The rapid increase in H-1B use from 1995 to 1998, as shown in Fig. 2, was a direct result of a major influx of IT workers.

Fig. 3 shows the number of H-1B admissions by worker's country of origin from 1992 to 2001. The United Kingdom was the source of the largest number of admissions in 1992, and India ranked number three with 8246, or 7.5%, of the 110,193 total. However, by 1996, India ranked number one with 29,239, or 20.2%, of the 144,458 total. The rapid increases in H-1B workers in the late 1990s was due primarily to major increases in Indian IT workers. While there are no reliable sources for the stock of engineers and computer scientists in countries, it is unlikely that India had a monopoly on the worldwide IT labor stock in the late 1990s. For example, Russia produced more than 82,000 and China more than 195,000 engineering graduates in 1999, but neither are high on the list of H-1Bs [5].

By 2001, India was, by far, the largest source of H-1B petitions. The BCIS approved 331,206 H-1B petitions in 2001, 161,561 or 49%, went to Indian nationals.<sup>1</sup> The next closest country was China, with 27,331, or 8%, approved petitions. Almost all, 92%, of the petitions

<sup>1</sup> The number of H-1B petitions approved and the number of H-1B temporary workers admissions are not comparable because they measure different populations. Petitions approved pertain to H-1B petitions authorizing temporary employment for specialty workers, either in the United States or overseas, while admissions represent H-1B workers arriving from abroad. H-1B petitions can be approved for aliens changing nonimmigrant status without leaving the United States. Most significantly, H-1B workers can be admitted multiple times using a single petition and be admitted with a petition approved in a prior fiscal year [5].

for Indian workers were for computer-related or engineering occupations. It is clear that employers of Indian nationals with IT skills are the heaviest users of the H-1B [6].

Why do IT services firms use the H-1B so extensively? Many firms have claimed that the acute workforce shortages of the late 1990s forced them to turn to the H-1B [7]. However, critics of the visa program have claimed that companies pay H-1B workers below market wages [8]. Labor cost is a major driver in winning business in the IT market, and, if H-1Bs are a cheaper alternative to American workers, then, those companies utilizing the H-1B will have a competitive advantage. Zavodny [9] was unable to find a relationship between H-1B workers and unemployment rates or wage depression amongst U.S. workers at the state level. However, in an interview in a leading Indian business magazine, a TCS executive essentially stated that the workers that his firm hires are cheaper. He said, “Our wage per employee is 20–25% lesser than US wage for a similar employee. Typically, for a TCS employee with five years experience, the annual cost to the company is \$60,000–70,000, while a local American employee might cost \$80,000–100,000. This (labour arbitrage) is a fact of doing work onsite. It’s a fact that Indian IT companies have an advantage here and there’s nothing wrong in that”. [10].

Why would an Indian H-1B worker accept a lower salary than that of a comparably skilled American? Salaries for IT workers from India are significantly lower than in the United States, thus, salary expectations are lower. Moreover, many Indian H-1B workers prefer to live in the United States, a nonmonetary benefit that compensates for a lower salary, and some companies promise the possibility of permanent immigration [8]. While the cost of living in the United States is higher than in India, the H-1B’s perception of his or her net pay is influenced by the substantial differences in purchasing power parity (PPP), an international cost of living index, between the United States and India. The World Bank has calculated a PPP of approximately 0.2 between India and the United States, which means that US\$10,000 in India has the same purchasing power as US\$50,000 in the United States [11]. This PPP differential amplifies any savings by the Indian H-1B workers by a factor of five (Table 3).

Another potential advantage of hiring an H-1B is that the employer holds the visa, therefore making it more difficult for an employee to leave. The H-1B regulations include safeguards to prevent employers from paying a lower wage, but the enforcement of those regulations is limited. The LCA application form submitted to the DoL contains an entry that requires the employer to list the prevailing wage for the occupation in the city of intended employment. This provision is included to ensure that the H-1B workers are not paid less than a U.S. equivalent worker is paid. However, the U.S. General Accounting Office (GAO) found

Table 3  
Salaries for equally well-off engineers

Country	PPP	Salary (US\$)
U.S.	1.0	70,000
Hungary	0.367	25,690
China	0.216	15,120
Russia	0.206	14,420
India	0.194	13,580

that although employers may be required to pay H-1B workers a prevailing wage, DoL officials said that employers can use almost any source to determine it, and the DoL does not have the authority to verify the authenticity of the information unless it is obviously incorrect. The GAO also found that the DoL has very limited authority to initiate any enforcement actions against employers that violate the regulations, and, as a result, the process is vulnerable to abuse [12].

Fig. 4 shows the number of L-1 intracorporate transfer visa admissions from 1992 to 2001. The chart indicates that the L-1 has been a much smaller source of admissions of workers from India than the H-1B is, but its importance grew significantly from 1996 to 2000. This is in contrast to the aggregate level data presented in Fig. 1, which showed that increases in L-1 admissions have been steadily increasing since 1992. The U.K., Japan, and France are large trading partners with the United States, and they own significant assets and businesses in America. U.S.-based businesses also own large assets and business operations in those countries. Therefore, it is not surprising that the number of L-1 admissions from those countries is high, but it is rather surprising why India's number is so much higher than those of China or Korea.

It is clear, at the macrolevel, that India has been an important source of IT workers in the United States, primarily coming on H-1B and L-1 visas. No other country had comparable increases in rates or scale. The data also show that many software body shop companies began to utilize the H-1B visa extensively between 1995 and 1998. The H-1B visa program

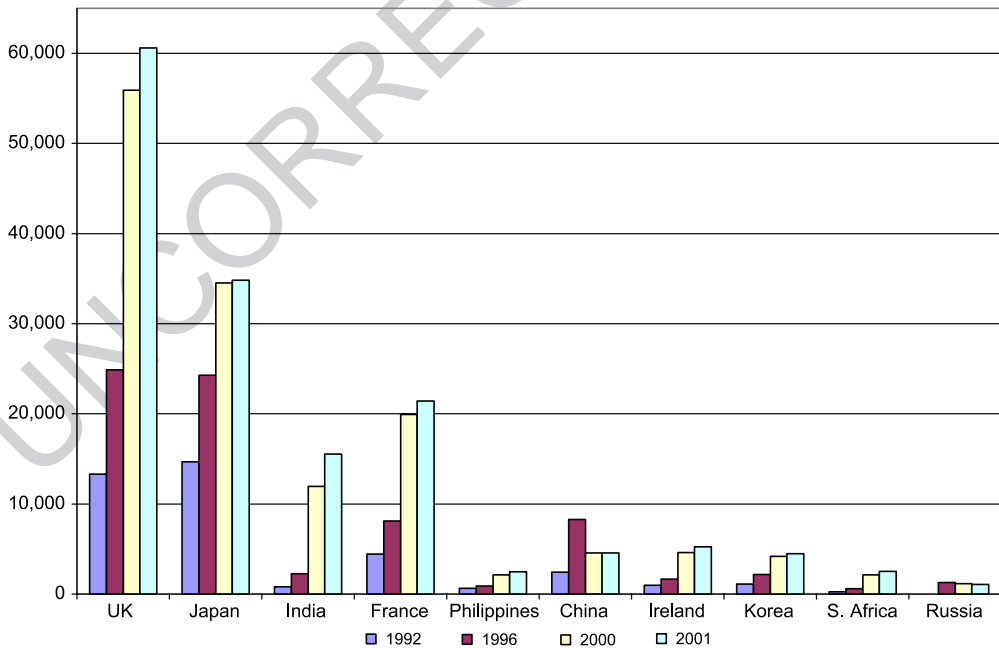


Fig. 4. L-1 admissions by country from 1992 to 2001.



was critical for employers of Indian IT workers. The next section quantifies the importance of the visa programs for the Indian IT industry. 199  
200

### 3. The importance of the H-1B and L-1 visas for Indian IT companies 201

The leaders of the Indian IT industry recognize that the H-1B and L-1 programs are important for their industry's health. They have enlisted lobbyists in the United States and issued a number of media releases to fight against any restrictions in the visa programs [13]. In fact, NASSCOM President Kiran Karnik has said that restrictions on the H-1B and L-1 visa programs would adversely affect the Indian IT industry [14]. 202  
203  
204  
205  
206

Unfortunately, it is impossible, with publicly available data, to calculate the impact that each program has had on the entire Indian IT industry. The BCIS does not collect data on the number of H-1B and L-1 holders currently employed in the United States, nor does it identify the employers. It is possible to approximate the impact by analyzing three of the leading Indian IT firms. 207  
208  
209  
210  
211

The three leading Indian IT firms are used as a proxy for the industry in this paper. Those firms provide detailed information on their use of H-1B and L-1 in financial statements submitted to the U.S. Securities and Exchange Commission. Other financial data show how critical the temporary workers are to the business in generating both revenue and earnings. 212  
213  
214  
215

#### 3.1. Indian IT firm use of H-1B and L-1 visas 216 217

Indian IT firms use temporary workers extensively to deliver services to U.S. clients, a critical part of their business strategy. When describing business risks, the largest publicly traded Indian IT firms describe the importance of the H-1B and L-1 visas to their operations. For example, Wipro has stated in its annual report, "If U.S. immigration laws change and make it more difficult for us to obtain H-1B and L-1 visas for our employees, our ability to compete for and provide services to clients in the United States could be impaired. . . This restriction and any other changes in turn could hamper our growth and cause our revenues to decline", [15]. Satyam, another leading Indian IT firm has stated in its annual report that "U.S. immigration restrictions could limit our ability to expand our U.S. operations" [16]. It is clear from these statements that the management believes that U.S. immigration laws will affect the business prospects of their companies. 218  
219  
220  
221  
222  
223  
224  
225  
226  
227  
228

These firms, unlike most IT services firms, have also identified the number of H-1B and L-1 workers they employ. Infosys has stated in its annual report, "As of March 31, 2002, the majority of our personnel in the United States held H-1B visas (1,582 persons) or L-1 visas (445 persons)" [17]. Satyam and Wipro have expressed similar statements in their respective annual reports. As part of their business strategy, Indian IT firms have chosen to hire foreigners working on temporary visas rather than American permanent residents or citizens. Cost is the most likely reason for the preference of foreign workers, as described by the TCS executive earlier. Regardless of the reason for the preference, the H-1B and L-1 workers play a key role in their business models. 229  
230  
231  
232  
233  
234  
235  
236  
237

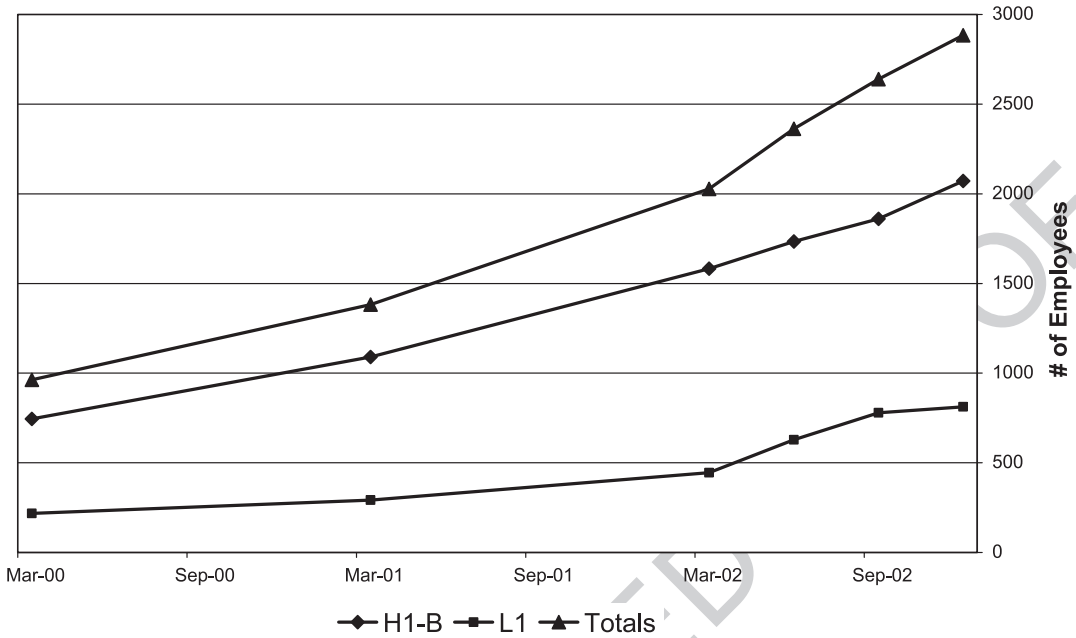


Fig. 5. Infosys' use of H-1B and L-1 for 2000–2002.

Fig. 5 shows Infosys' visa use from March 2000 to December 2002. The trends indicate an acceleration in the number of visas, in particular, in the L-1 visa. By the end of 2002, at the peak of the NASDAQ bubble, Infosys had 2884 employees on temporary visas in the United States, a 200% increase from March 2000. H-1B and L-1 workers represented approximately 21% of Infosys' worldwide workforce.

The BCIS tracked the leading H-1B petitioners for a short window from October 1999 to February 2000, and the top 15 firms are shown in Table 4 [18]. Three of the top Indian IT firms, TCS, Wipro, and Infosys, are among the top H-1B petitioners. Not only do the Indian

Table 4  
Top H-1B petitioners, Oct. 1999–Feb. 2000

Rank	Company	Rank	Company
1	Motorola	9	Wipro
2	Oracle	10	Tata Consultancy Svcs
3	Cisco Systems	11	Price WaterhouseCoopers
4	Mastech	12	People Com Consultants
5	Intel	13	Lucent Technologies
6	Microsoft	14	Infosys
7	Rapidigm	15	Nortel Networks
8	Syntel	16	Tekedge

Table 5

Infosys' revenue from North American clients

Fiscal year	Total annual revenue (US\$)	North American revenue (US\$)	% Of total revenue attributable to North American clients
2000	203,443,754	158,723,649	83
2001	413,850,510	304,242,537	62
2002	545,051,214	388,168,447	72

IT firms use a large number of H-1B and L-1 visas, but they also are among the leaders in H-1B petitions.

### 3.2. U.S. clients are important customers for Indian IT firms

The impact of temporary workers is modulated by the amount of business that Indian firms derive from U.S. clients. U.S. clients represent a significant portion of the Indian IT firms businesses, and temporary visa holders generate a large share of revenue and earnings from servicing those clients. Revenues and earnings are approximated by using data from the Indian IT firms' financial statements.

Infosys is analyzed first. North America is the most important geographic segment for Infosys because it accounts for the majority of the company's revenue and earnings. Tables 5 and 6 show that North American clients accounted for between 62% and 83% of the firm's total annual revenue and between 71% and 81% of its operating earnings from FS 2000 to 2002.

The contribution of temporary visa holders to Infosys' revenues is estimated by calculating a factor, the average onsite revenue per person/year. This indicates how much each onsite worker contributes to the company's revenues. If we then multiply this factor by the number of visa holders, we can estimate the revenue directly attributable to visa holders.

The total onsite revenue for FY 2002 for Infosys was US\$276.72 million. This revenue was generated by 2014.42 person/years worth of effort [17]. On average, each person working onsite generated approximately US\$137,370 (US\$276.72 million/2014.42) of revenue per year, a figure that is comparable with IT services firms operating in the United States. Note that this figure also takes utilization rates (i.e., some worker hours are not billable) into account.

Table 6

Infosys' earnings from North American clients

Fiscal year	Total operating earnings (US\$)	Operating earnings from North America (US\$)	% Of operating earnings attributable to North America
2000	77,884,858	63,176,215	81
2001	167,124,247	125,830,720	75
2002	217,164,653	154,712,508	71

Table 7 t7.1  
 Infosys' revenue generated temporary visas t7.2

Fiscal year	Total number of H-1B and L-1	Estimated annual revenue from personnel on temporary visas (US\$)	Total annual revenue for infosys for North American segments (US\$)	% Of total annual North American revenue directly attributable to temporary visa personnel (%)	
2000	963	132,287,310	158,723,649	83	t7.3
2001	1382	189,845,340	304,242,537	62	t7.4
2002	2027	278,448,990	388,168,447	72	t7.5

Based on the onsite average revenue per person/year factor above, [Table 7](#) shows Infosys' estimated revenue directly attributable to temporary visa personnel. Personnel on temporary visas directly contributed between 62% and 83% of the firm's North American revenue from FS 2000–2002. Taking the results from [Tables 5, 6, and 7](#), one could estimate that they directly accounted for 52% of revenue and 51% of earnings for the entire firm for 2002.

Temporary visas may be important for Infosys, but is it also true for other Indian firms? The revenue and earnings statistics for two other leading Indian IT firms, Satyam and Wipro, are shown in [\[Tables 8 and 9\]](#) [\[15,16\]](#). A metric for revenue per person/year was not available for Satyam or Wipro, thus, Infosys' factor, derived above, is used in the calculations.

FS 2002 revenue data for Wipro and Satyam are shown in [Tables 8 and 9](#). [Table 8](#) shows that the estimated revenue due to personnel on temporary visas is large and represents a significant portion of overall revenue. Wipro's data deviates from that of the others because it is more diversified, with a large portion of its total revenue coming from the Indian market and in non-IT lines. However, Wipro's Global IT segment, with clients outside of India, is the company's fastest growing business line and accounted for 67% of its revenue and 92% of its operating earnings [\[15\]](#).

[Table 8](#) shows that temporary visa personnel directly contribute 61% and 65% of the U.S. client revenue for Satyam and Wipro, respectively. These figures indicate that all three firms are highly dependent on temporary visa personnel.

Three of the leading Indian IT firms are dependent on the North American market, and their temporary workers in the United States account for a significant amount of the revenue and earnings for the companies. While the sample is small, most of the Indian IT exporters are in similar business lines.

Table 8 t8.1  
 Satyam and Wipro revenue generated by personnel on temporary visas t8.2

Fiscal year	Total number of H-1B and L-1	Estimated annual revenue from personnel on temporary visas (US\$)	Total annual revenue for all geographic segments (US\$)	Annual revenue from U.S. clients (US\$)	
2002					t8.3
Satyam	1322	181,603,140	414,491,000	298,458,000	t8.4
Wipro	1231	169,102,470	696,000,000	260,000,000	t8.5

Table 9

Satyam and Wipro percent of revenue from temporary visas

Fiscal year 2002	% Of total annual operating revenue directly attributable to temporary visa personnel	% Of total annual revenue from U.S. clients	% Of total annual revenue from U.S. clients directly attributable to temporary visa personnel
Satyam	44	72	61
Wipro	24	37	65

### 3.3. Offshore work depends on onsite access

The fastest growing segment of India's IT export business is offshore work [18]. The importance of temporary workers is amplified through their critical relationship to winning and directing projects completed offshore. Table 7 shows that a large portion of the total revenue for Infosys is generated by onsite personnel working in the United States on temporary visas. The importance of those onsite personnel goes beyond their direct contributions to revenue generation. In fact, offshore work often depends on onsite personnel. An example helps to illustrate how this works. Mastek, a Mumbai-based IT services firm, provides the following example in one of its marketing white papers.

Staff Costs Assumption: U.S. onsite \$100,000 per year

Offshore cost: \$50,000 per year. A Fortune 1000 company needs 60 man-year's worth of effort. If they used only U.S. labor, then the cost would be  $60 \times \$100,000 = \$6$  million. If the company used 60 people that consisted of 20 onsite and 40 offshore, then the costs would be  $20 \times \$100,000 + 40 \times \$50,000 = \$4$  million. Thus if the client used the offshore model, it could realize a 33% cost savings or \$2 million.

This example illustrates something that I define as the *offshore-to-onsite leveraging ratio*. In this example, the *employee leveraging ratio* is 40:20, or 2:1; the *revenue leveraging ratio* is US\$2 million:US\$2 million, or 1:1. The leveraging ratio varies greatly from project to project because of the nature of the work and the IT firms' capabilities. Some projects require extensive face-to-face interaction with the client onsite, whereas others can be completed almost entirely offshore.

The relationship between onsite and offshore personnel cannot be easily estimated, but because of the nature of the software services business, which requires significant customer interaction, onsite personnel are critical to a successful project. If the employee leveraging ratio could be increased significantly through the use of technology or better management, then, the need for onsite personnel will be reduced along with the demand for and importance of temporary visas.

### 3.4. Current demand for temporary visas

Another way to calculate the importance of temporary work visas for Indian IT firms is to estimate the demand for H-1Bs. A proxy for this value is to count the number of LCAs

Table 10  
2001 LCA requests by leading Indian IT firms

Company	Number of employees requested on LCAs	Total LCA wages to be paid (US\$ millions)	Average wages paid per position per year (US\$)
Wipro	3120	158	50,648
HCL	3828	147	38,428
Satyam	8692	483	55,621
Tata	11,982	437	36,502
Infosys	12,211	657	53,880
Totals	39,833	1884	47,294

Source: U.S. DoL.

that firms have filed with the DoL. Table 10 shows LCA requests by leading Indian IT firms for FS 2001. The number of LCAs requested is an imperfect measure of H-1B demand because not all LCAs will become actual petitions to the BCIS for H-1B visas. However, it is quite clear that all of the companies are planning to expand their pool of H-1B workers. For example, Infosys requested as many LCAs as it had employees worldwide in FY 2001.

U.S. IT services firms do not use the H-1B in the same way as Indian IT firms do in two key ways—magnitude and wage rates. Table 11 shows that the number of employees requested for the U.S. firms Electronic Data Systems and American Management Systems is far smaller, and the average wage requested is higher. It also shows that the LCA wages requested relative to the company's size (as measured by revenues) is orders of magnitude smaller for the U.S. firms; for example, if American Management Systems petitioned the BCIS for all of its LCAs, those workers would account for 1.43% of its 2001 revenues, in contrast to the 69.31% for Tata.

The H-1B and L-1 visa programs are critical business strategies for individual Indian IT firms. The H-1B visa cap was significantly expanded in the late 1990s to redress a shortage of IT professionals in the United States. However, the U.S. IT market has been stagnant, and the

Table 11  
U.S. vs. Indian IT firm LCA use

Company	Number of employees requested on LCAs	LCA wages to be paid (US\$ millions)	Average wages per position per year (US\$)	Total revenues for 2001 (US\$ millions)	LCA wages requested <i>H</i> total revenues (%)
EDS (US)	452	32	71,251	21,543	0.15
AMS (US)	246	17	68,550	1183	1.43
Wipro	3120	158	50,648	414	38.17
Tata	11,982	437	36,502	631	69.31
Satyam	8692	483	55,621	310	155.95

H-1B cap has reverted to 65,000. What are the implications of the IT slowdown in the United States and what are the possible changes in the visa regime on Indian IT companies? 343  
344

#### 4. Slowdown in the U.S. IT market and adaptation by the Indian IT firms 345

India's software services are still primarily exported to U.S. customers; therefore, the industry's current and future prospects are heavily dependent on U.S. IT demand. According to NASSCOM, the United States accounts for 68% of Indian IT exports in 2002 [18]. In addition to current sales, America is critical for India's IT future development because it has the largest market with the most sophisticated customers. The exposure to the technological and business environment in the United States also has been a boon to Indian firms, enabling them to pursue new business lines outside of software services, including call center operations and business process outsourcing. 346  
347  
348  
349  
350  
351  
352  
353

The IT business and labor market conditions in the United States during the late 1990s provided a golden opportunity to develop India's IT industry. U.S. IT demand exploded over the past decade because of technological, business, and labor market changes. Major technology paradigm shifts in computer hardware, software, and network technologies created disruptions in the normal evolution of IT systems and sparked the demand for IT services and temporary workers [19]. However, conditions have drastically changed, and U.S. IT demand has stagnated, which has made the market more competitive. Supplier growth will only be generated by increasing market share. 354  
355  
356  
357  
358  
359  
360  
361

Stagnant demand has led to record unemployment rates for American IT workers, causing a number of groups to call on the U.S. Congress to place greater restrictions on the H-1B and L-1 visas [20]. If those restrictions pass, they could have a major impact on the ability of Indian IT firms to generate revenue from onsite personnel. 362  
363  
364  
365  
366

##### 4.1. U.S. IT slowdown: challenges for Indian IT firms 367

How will the decreased growth rates of U.S. IT demand affect Indian IT services exporters? The good news for India's IT firms is that their share of the North American IT market is still quite small. Even if U.S. demand remains flat, the Indian IT industry can grow by increasing the market share. However, a number of business and policy challenges will remain for the industry. 368  
369  
370  
371  
372

Onsite project work in the United States is still a significant share of Indian IT services, thus, access to clients in the United States is critical to capturing business opportunities. As described earlier, the H-1B and L-1 visa programs have been the primary vehicles for providing that onsite access. However, the political landscape for temporary visas has changed markedly in 2003. There are four bills pending in the U.S. Congress to restrict or even eliminate the H-1B and L-1 visas. At least one of the bills, H.R. 2154, was introduced as a direct result of L-1 business practices by TCS [21]. In addition, the Senate Judiciary Committee has held two full committee hearings on H-1B and L-1 visa use and misuse. 373  
374  
375  
376  
377  
378  
379  
380  
381

In addition to potential restrictions on labor mobility to America, developing countries will face stiffer price competition from the increases in IT supply from China and Central and Eastern European nations. India may be the first mover into the IT services export market, but it is hardly alone in hoping that it will be the engine for export-led growth. Increased supply, with little demand expansion, will create significant pricing pressure, and service providers will need to differentiate their product offerings by something other than price. The post-September 11th climate in the United States has also created a dampening effect on the free flow of people and raised the consciousness of the risks associated with outsourcing critical IT functions, especially overseas.

As more IT services suppliers from other developing countries enter the U.S. market, there will be more competition for the limited number of H-1B slots. Even with the technology slowdown in 2001 relative to 2000, the number of H-1B petitions increased from approximately 258,000 to 331,000. The number of H-1B petitions that counted against the cap in 2001 was 201,079. Although initial indications are that the numbers for 2002 and 2003 will be smaller, they would still far exceed 65,000, the cap that has come into effect for 2004.

On the international trade treaty front, developing countries had hoped that the current round of negotiations on the General Agreement on Trade in Services would be used to argue for the elimination of quota and wage parity provisions on visas like the H-1B in the United States [22]. A preview of how those kinds of provisions might be perceived occurred in July 2003. America's bilateral free trade agreements with Chile and Singapore both included provisions that significantly loosened H-1B and L-1 restrictions [23]. The reaction by the U.S. Senate Judiciary Committee was negative, and it is unlikely that such provisions will appear in future trade treaties without prior approval by Congress.

#### *4.2. Indian IT firms adapt business practices to reduce dependence on H-1B*

Temporary visas have been an important source of competitive advantage for Indian IT firms, but they may become more difficult to obtain. One logical way for Indian IT firms to adapt is to reduce their dependence on the H-1B. There are two primary ways that they can directly reduce their demand of H-1Bs. One method would be to find a substitute visa such as the L-1. The second method would be to improve the offshore-to-onsite leveraging ratio. Secondary methods to reduce H-1B dependence include strategic partnerships or joint ventures with U.S.-based firms, in which the U.S. firm manages the onsite work and the Indian firm performs the offshore work. In fact, with current equity valuations favoring Indian IT firms over U.S. ones, Indian firms may decide to purchase some of their U.S. counterparts.

The L-1 visa has advantages over the H-1B because it is not subject to a cap. While there are more restrictions on which personnel are eligible for the L-1, Infosys seems to be favoring the L-1 over the H-1B in recent quarters, as shown in Fig. 5. The L-1 visa may offer relief from the H-1B cap, but increasing the offshore-to-onsite leveraging ratio offers expanded opportunities in new business lines, higher profits, and greater benefits to the Indian economy.



Table 12

Infosys' offshore-to-onsite leveraging ratios

Fiscal year	Revenue leveraging ratio	Employee leveraging ratio
2001	0.94	1.94
2002	0.97	2.26

It is difficult to estimate an average leveraging ratio, but the ratio is likely to increase for all Indian IT firms because it is in the interests of both the customer and the Indian IT service provider to increase the proportion of offshore work. The customer benefits from lower costs because of lower wages, and the Indian IT firms have higher gross margins for work completed offshore [17]. The average leveraging ratio will also increase as more customers gain confidence in shifting a greater portion of a project offshore and as Indian IT firms improve their project management skills and information infrastructure. Information and communications technologies, such as videoconferencing and webconferencing, will facilitate more remote work. The beginnings of this is evident from the data in Table 12, which shows that Infosys slightly increased both its employee leveraging and revenue leveraging ratios from 2001 to 2002.

While there will be increases in average leveraging ratios for most Indian IT firms over time, it is likely that they will reach an upper bound because some work will still require onsite presence.

Strategic partnerships and joint ventures between Indian and U.S. IT firms already exist. For example, Wipro has a joint venture with General Electric. Indian IT firms could partner with U.S.-based firms, such as Electronic Data Systems, which would manage and source the onsite personnel with the Indian IT partner providing the offshore labor. Another interesting development might be that Indian IT firms purchase their U.S. counterparts. Table 13 shows that the larger Indian IT firms could purchase some of their U.S. counterparts. Wipro recently purchased AMS' utilities business practice in Europe [24].

Table 13 shows that Indian IT firms have a major comparative advantage over U.S. firms in most financial metrics. In fact, investors seem have bid up the market capitalizations of the largest Indian IT firms to levels that rival or surpass the largest U.S. IT firms despite their significantly lower revenues. For instance, the price-to-revenue ratio for Wipro and Infosys are 20 to 30 times that of the U.S. firms.

Table 13

Comparison of equity market valuations of U.S. and Indian IT firms, January 12, 2003

Company	Country of head quarters	Market capitalization (US\$ billions)	Revenue (US\$ billions)	P/E ratio	Profit margin (%)	Price/Revenue ratio
AMS	US	0.5	1	21	2	0.5
CSC	US	5.9	11.4	15	4	0.5
Wipro	India	7.8	0.8	44	23	9.8
Infosys	India	9.2	0.6	53	28	15.3
EDS	US	9.3	22	8	5	0.4

## 5. Conclusion

450

Many factors have spurred India's IT industry development. This paper has highlighted an additional factor that is overlooked in the literature: India's IT industry grew because of its use of U.S. immigration regulations as a competitive business practice. Estimates of the importance of this factor were presented at the macro and firm levels.

Market conditions have changed drastically, and the immigration regulations that were once a competitive advantage for Indian IT firms may be restricted, posing a significant challenge for Indian IT firms. At the same time, other developing countries are entering the IT market as suppliers, and U.S. demand is leveling off. This will create a more competitive market for all suppliers and will force strategic adaptation. Firms have plenty of opportunities to adapt to the new regulatory environment by increasing their offshore-to-onsite leveraging ratio, utilizing alternative visas, improving their product differentiation, and partnering with U.S.-based businesses.

## References

463

- [1] National Association of Software Services Companies, [www.nasscom.org](http://www.nasscom.org). 464
- [2] A. Arora, V.S. Arunachalam, J. Asundi, R. Fernandes, The Indian software services industry, *Heinz School of Public Policy Working Paper*, Carnegie Mellon University, 2000. 465
- [3] G. Das, *India Unbound: A Personal Account of a Social and Economic Revolution from Independence to the Global Information Age*, Alfred A. Knopf, New York, NY, 2001. 467
- [4] R. Heeks, *The Uneven Profile of Indian Software Exports*, vol. 3. Development Informatics Working Paper Series, Manchester, UK. October 1998. 469
- [5] U.S. National Science Foundation, *Science and Engineering Indicators*, 2002, Table 2–18. Arlington, VA. 471
- [6] U.S. Immigration and Naturalization Service, *Statistical Yearbook of the Immigration and Naturalization Service*, Washington D.C., 1992, 1996, 2000, and 2001. 472
- [7] D. Lewis, For IT workers, guarded optimism about jobs, *Boston Globe* (2002 May 6). 474
- [8] N. Matloff, *Needed Reform for the H-1B and L-1 Work Visas: Major Points*, unpublished, August 17, 2003, <http://heather.cs.ucdavis.edu/Summary.pdf>. 475
- [9] M. Zavadny, The H-1B program and its effects on information technology workers, *economic review*, Fed. Res. Bank Atlanta 88 (3) (2003) 1–11. 477
- [10] S. Singh, U.S. Visas are not a TCS Specific Issue, *Bus. World* (2003 June 30). 479
- [11] World Bank, *International Comparison Program: World Development Indicators*, Author, Washington, DC, 2002, Table 5.6. 480
- [12] U.S. General Accounting Office: *H-1B Foreign Workers: Better Controls Needed to Help Employers and Protect Workers*, Report Number GAO/HEHS-00-157, September 2000. 482
- [13] S. Rai, Software success has India worried, *N. Y. Times* (2003 February 13). 484
- [14] H1B Visa Reduction to Affect Indian IT Industry, *The Press Trust of India*, 2003 August 22. 485
- [15] Wipro, Form 20-F, Annu. Rep. (2003 March 31). 486
- [16] Satyam Computer Services, Form 20-F, Annu. Rep. (2003 March 31). 487
- [17] Infosys Technologies Limited, Form 20-F, Annu. Rep. (2003 March 31). 488
- [18] NASSCOM, *Indian Software and Services Exports*, 2003 September 10, unpublished. 489
- [19] R. Hira, Boom-Bust: New paradigm for EE employment, *Res. Technol. Manag.* 46 (2) (2003) 2–9. 490
- [20] J. Steadman, *Examining the Implications of the H-1 Visa for the American Economy: Testimony to Committee on the Judiciary of the U.S. Senate*, 2003 September 16. 491

- [21] B. Grow, A loophole as big as a mainframe, *Bus. Week* (2003 March 10). 493
- [22] R. Chanda, Movement of natural persons and trade in services: Liberalising temporary movement of labour under the GATS, Working Paper No. 51, Indian Council for Research on International Economic Relations (1999). 494  
495  
496
- [23] P. Magnusson, Is a stealth immigration policy smart? *Bus. Week* (2003 July 21). 497
- [24] Can acquisitions help Wipro join the big league? *India Business Insight*, 2003 June 30. 498

UNCORRECTED PROOF