Engineers need better data and government help to "adjust" to offshoring.

Impacts and Trends of Offshoring Engineering Tasks and Jobs

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Many companies are transferring tasks and jobs that have traditionally been done by American engineers to lower cost countries where engineers earn as little as 10 percent of the salaries Americans earn. Company managers, making rational decisions, hope to save up to 70 percent in net costs by offshoring work. Although no government organization has reliable figures on exactly how many engineering tasks and jobs have been moved to low-cost countries in recent years, observable trends indicate that offshoring is accelerating in scale and scope. No doubt these changes have important implications for American engineers and the U.S. national innovation system; but engineers have little objective information to help them adapt to these changes, and, in spite of widespread media attention, policy makers have so far chosen to do nothing in response to these structural changes to our innovation system.

On the macroeconomic level, economists are debating whether offshoring is good for America. In a recent article in the *Journal of Economic Perspectives*, for example, Nobel laureate Paul Samuelson describes some very plausible scenarios in which offshoring would actually leave America worse off.

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[1] The opinions expressed in this paper are those of the author and do not represent the official position of IEEE-USA. For more information on the subjects discussed here, see *Outsourcing America: What's Behind Our National Crisis and How We Can Reclaim American Jobs* by Ron Hira and Anil Hira (AMACOM, 2005).

Ralph Gomory and William Baumol (2001) demonstrate that standard trade theory shows multiple outcomes for trading partners. In some outcomes, both partners benefit; in others, one country gains and the other loses.

The net effects of offshoring on the U.S. economy are uncertain, but engineers and the engineering community can begin adapting if they understand the anticipated impacts on the labor market and begin tracking observable trends. This information can also help policy makers explore feasible policy responses.

Impacts of Offshoring on Employment[2]

Most economists believe that offshoring will have little or no long-term impact on the overall number of jobs or the unemployment rate in the United States. According to their models, the total number of jobs in the United States is a function of the size of the labor force (primarily influenced by population), and the unemployment rate is a function of monetary and fiscal policies. They argue that individual jobs may indeed disappear at the microeconomic level as they are moved overseas, but the displaced workers will find jobs elsewhere in the economy as new opportunities arise or are created.

In the short term, offshoring is expected to have the following impacts on employment: (1) job displacement for U.S. workers; (2) a change in the mix of U.S. occupations; and (3) downward pressure on wages for jobs that are newly tradable across borders.

Job Displacement

Some U.S. workers will lose their jobs as their work is shifted to overseas locations. In July, for example, Wachovia Corporation announced plans to move many of its information technology (IT) jobs to India and told its 3,000 U.S. IT workers to prepare for lay-offs. The assumption is that these about-to-be displaced workers will be reemployed rapidly, and at substantially the same wages, as they "adjust," as economists say, to structural changes in the economy.

In reality, the adjustment process—workers seeking and finding opportunities at other companies, in other geographic regions, and/or in other occupations—is difficult. The data on reemployment outcomes are limited, but we can get an indication from the Bureau of Labor Statistics *Displaced Workers Survey* (2004). The survey shows that, of workers who were displaced between 2001 and 2003, 35 percent were still unemployed in January 2004, and, of the 65 percent who were employed, only 43 percent earned as much as they did before displacement. Thus, the empirical data show that displaced workers are not reemployed rapidly (one in three remains unemployed) or at the same or higher wages (three in five took pay cuts).

These outcomes are largely consistent with results of surveys of displaced workers conducted since 1979. Significant numbers of displaced workers are likely to remain unemployed for extended periods of time, and many of those who find work take substantial pay cuts.

Macroeconomic job creation is an important factor in the rate and quality of reemployment. If many new jobs are being created, a worker's chances of successful reemployment increase. Unfortunately, levels of job creation in the most recent economic expansion of the U.S. economy have been unusually low. Although most macroeconomic indicators, such as robust expansion of the gross domestic product (GDP), have been favorable, job creation has been far weaker than during any other recent recovery from recession.

Job creation during the latest economic recovery has been weaker than during any other recovery from recession.

There are a few good explanations for why the economic expansion has not generated jobs up to historical norms. In the 44 months since the recession ended in November 2001, the economy has created 2.907 million new jobs, or an average of 793,000 jobs per year. Job creation for the 44 months after the previous recession, which ended in July 1991, was 8.575 million jobs, an average of 2.339 million per year. Just to keep up with new entrants in the labor force from demographic changes, the economy must create about 1.8 million jobs per year. Therefore, adjustment is more difficult than usual for displaced workers trying to find employment in their own or other occupations.

[2] The term offshoring as used in this paper encompasses offshore outsourcing.

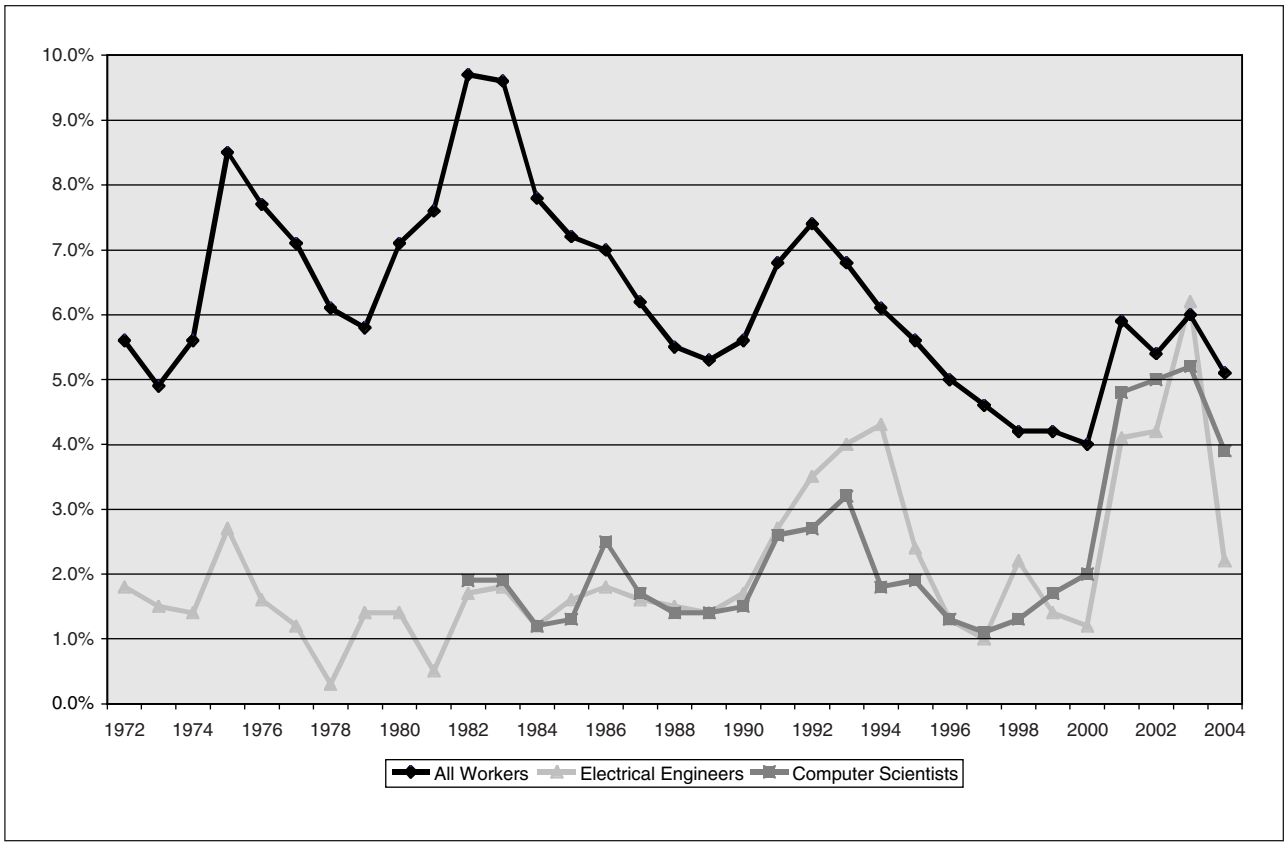

FIGURE 1 Unemployment rates for U.S. electrical and electronics engineers. Source: IEEE-USA, adapted from BLS, 2004.

As Figure 1 shows, U.S. electrical and electronics engineers and computer scientists experienced higher levels of unemployment in the past four years than during any other four-year period since 1972. In 2003, for the first time, the unemployment rate for electrical and electronics engineers (6.2 percent) exceeded the national unemployment rate (6 percent). To put this in historical perspective, throughout the whole decade of the 1980s, unemployment among electrical and electronics engineers never rose above 2 percent, despite national unemployment rates that peaked at 9.7 percent.

In addition, because of the slack labor market, wages of those who are employed fell slightly. For the first time in the 31 years that IEEE-USA has been surveying its members, median compensation declined in 2003. Although unemployment rates improved markedly among electrical and electronics engineering in 2004, this was partly due to increased hiring and partly due to engineers dropping out of the profession and looking for work in other occupations. Electrical and electronics job creation has not been robust enough to make up for earlier losses.

Many factors, such as the telecommunications bust, have contributed to the slack market for electrical and electronics engineers. But, understandably, they have expressed greater concerns about offshoring than some other professionals, such as accountants, who have benefited from high demand generated by the Sarbanes-Oxley regulations. In addition, engineers who are unemployed for an extended period of time may face higher burdens than the average U.S. worker. If it's true that "the half-life of an engineer is three to five years," engineers who are out of work for a year or more risk losing cutting-edge skills much more rapidly than displaced workers in other occupations.

Mix of U.S. Occupations

The second effect of offshoring predicted by economists is a change in the mix of U.S. occupations, as some jobs migrate to more efficient (lower cost) overseas locations. As some sectors are lost, the United States will specialize in sectors in which it has a comparative advantage. However, there is no guarantee that the new mix of U.S. occupations will be better. In fact,

economists cannot predict what types of new jobs will be created. This is a key policy question that no one can answer at this point. It is also a practical question. At every IEEE meeting I attend, I am invariably asked, "What new jobs should I be training for? What new skill sets will I need?"

Educators are grappling with the same questions. Engineering educators want to adjust curricula to help immunize their students against offshoring. But because most companies are reluctant to reveal their plans for offshoring, and because the government is not collecting data, we are all left to speculate about what kinds of jobs will go and what kinds will stay.

If the United States relinquishes many engineering and technology jobs, will we be able to replace them with better jobs? If the replacements are nontechnology jobs, how will that affect our ability to drive technological innovation? Conventional economic theories do not explicitly account for the impacts of offshoring on technological innovation and national security.

Wage Suppression

The third predicted effect on employment is wage suppression in jobs that are newly tradable across borders. Workers in these occupations are suddenly facing much more competition, which means they have less bargaining power. As some try to shift into nontradable tasks in the same or new occupations, competition for these jobs will also increase. Some observers believe that wage suppression, rather than job loss per se, will be the most significant effect of offshoring on U.S. employment.

Observable Trends in Offshoring

The types of jobs moving offshore do not follow a simple pattern, such as tasks requiring lower education levels moving offshore and higher level tasks remaining in the United States. Clearly, at least some high-level engineering design tasks are being moved offshore, and the primary driver is lower wages. Many top technology firms, such as Microsoft, General Electric, Google, and others, are building research and development centers in low-cost countries, and job openings posted on the websites of technology companies indicate that overseas engineering hires often require advanced degrees and experience. And the trend is not limited to established or mature companies. Many venture capital firms now require that the start-up firms they fund have offshoring plans.

IT services is the first-mover sector in the current, nonmanufacturing wave of offshoring. Thus, IT may be an indicator of things to come for other sectors. Because many of the larger IT firms are publicly traded, we can understand how offshoring is unfolding in IT services by examining their financial reports. Table 1 shows comparative basic financial data for the largest IT services firms with traditional business models and for firms that started with an offshore outsourcing model. As you can see from the table, two of the major offshore outsourcing companies, Infosys and Wipro (both based in India), have higher market valuations than their U.S.-based competitors, Electronic Data Systems (EDS), Computer Sciences Corporation (CSC), and Affiliated Computer Services (ACS). In 2004, for example, EDS had $21 billion in revenue and a $10.3 billion market valuation; Infosys, with only $1.6 billion in sales, had a $20.5 billion market valuation. In other words, Infosys has twice the market capitalization of EDS with one-twelfth the sales.

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Profit Margins

The reason for the high valuation of offshore outsourcers is quite simple. They have significantly higher profit margins, also shown in the table. In 2004, Infosys and Wipro had net profit margins of 31 percent and 20 percent, respectively, while EDS and CSC had net margins of 0.8 percent and 5.8 percent. And these differentials have been sustained for the past five years.

These comparisons demonstrate that IT offshore outsourcers are hardly small players. In fact, they are actually the market leaders. Rapid sales growth (39 percent for Wipro) results in rapid job growth (45 percent, or 14,500 new workers). Infosys added as many employees in the last quarter, approximately 5,000, as it did in its entire preceding fiscal year.

Rapid growth has enabled offshore outsourcing firms to raise extraordinary sums from public offerings on stock markets. At the same time last year that Google

TABLE 1 Comparative Financial Data for Traditional IT Firms and Offshoring IT Firms

	Traditional Model			Offshore Outsourcing Model		
	EDS	CSC	ACS	WIPRO	INFOSYS	COGNIZANT
Market Valuation (billions)	$10.3	$8.1	$6.2	$15.3	$20.5	$6.5
Employees	117,000	90,000	43,000	46,500	36,800	15,300
Sales (millions)	$20,669	$14,059	$4,106	$1,865	$1,592	$587
Net Profit Margin	0.8%	5.8%	12.9%	19.5%	30.8%	17.1%
Employee Growth	–11%	0%	8%	45%	43%	66%
Sales Growth	0%	–5%	8%	39%	50%	59%
Profit Growth	–109%	56%	73%	58%	53%	75%

Source: 2004 annual reports submitted to the U.S. Securities and Exchange Commission.

was raising $1 billion in an initial public offering (IPO) on Wall Street, Tata Consultancy Services, the largest Indian IT firm, raised a similar amount with an IPO on the Indian stock exchanges.

Indian offshore outsourcing firms have significantly higher profit margins than their U.S. counterparts for three reasons. First, and most important, profit margins on work performed offshore are higher than work done on site in the United States. Because a larger share of the staffs of offshore outsourcers is located overseas, these companies have higher profit margins than firms with traditional business models.

Second, the Indian government grants tax holidays on software and business process outsourcing exports. This advantage translates into much lower effective tax rates for Infosys and Wipro (between 13 and 14 percent) than for most U.S. companies, which had effective tax rates of approximately 35 percent.

Finally, many offshore outsourcing firms, based in India and the United States, are using the U.S. government-administered H-1B specialty occupation and L-1 intracompany transfer temporary visa programs to gain competitive advantages. The vast majority of the employees of these companies in the United States are H-1B or L-1 visa holders. Very few American citizens or permanent residents are hired and, in general, H-1B holders are not sponsored for permanent residence.

This serves two purposes. First, it enables companies to pay their on-site workers lower wages than comparable U.S. workers. Second, it facilitates the transfer of work overseas by providing a training ground for key employees. Foreign workers on site in the U.S. for extended periods of time gain critical experience with the most sophisticated customers.

In many cases, workers are part of a formal process known as "knowledge transfer," whereby U.S. workers are asked to train their foreign replacements. In some cases, this is a condition for the U.S. worker to receive severance pay and unemployment insurance. The foreign workers then return to the offshore location where they effectively act as liaisons to customers; in addition, they train additional offshore workers.

Companies with traditional business models are responding to these market leaders by moving more of their labor overseas. IBM will reportedly increase its head count in India from 6,000 in 2002 to 38,000 by the end of 2005. Accenture recently announced plans to increase its head count by 30,000 in India, China, and the Philippines over the next three years. EDS has announced that 20,000 jobs are being moved from high-cost to low-cost countries.

The robust hiring in India has spurred salary increases for some Indian technology workers. For example, Infosys has announced that its offshore salaries have increased 13 to 15 percent. However, salaries are not increasing across the board; most of the increases went to middle-level workers but not to entry-level or senior-level workers. Of course, the increases are on very low salaries, mostly in the range of $12,000 to $15,000, and it is unlikely that offshore wages will approach U.S. levels anytime soon.

In addition, a new labor supply is coming on line to meet demand as Indian universities turn out more

graduates, more workers rotate through the United States on H-1B visas, and more developing countries become attractive places for IT services. Indian IT firms, concerned about competition from even lower cost providers in China, are opening operations there. Tata Consultancy Services, for example, recently announced a joint venture with the Chinese government and Microsoft to help China enter the market. Thus, the primary attraction for companies to offshore—large wage differentials between U.S. and foreign workers—is likely to persist even as demand increases.

Policy Responses

There are no easy answers or silver bullets to the complex economic and employment challenges associated with offshore outsourcing. The general areas in which policy changes can help fall into six categories:

1. Collecting better intelligence to improve labor market signals and clarify the impacts of offshoring on technological innovation and national security.
2. Ensuring that government policies, such as tax incentives and visa programs, do not accelerate offshoring.
3. Taking preventive measures to help workers adapt before they are displaced.
4. Providing palliative measures to help workers who are hurt.
5. Providing recuperative measures to help workers obtain better reemployment.
6. Adopting measures to expand technological frontiers and accelerate the creation of high-wage jobs. (The focus should be on solutions that are geographically "sticky" and that help workers rather than companies.)

More than two years ago I dubbed the policy debate on offshoring the "new competitiveness debate" because I think lessons can be learned from the 1980s debate on competitiveness. The old debate has been extensively chronicled by Dr. Kent Hughes in his new book, *Building the Next American Century: The Past and Future of Economic Competitiveness* (2005). The most important lesson to be learned is that it takes time and creativity to generate sound public policy responses to major economic shifts.

The key difference between the new and old debates on competitiveness is that workers today are much more likely than companies to be adversely affected. This difference means that the practical and politically acceptable solutions that were used in the past will not work this time, and I suspect this will make it much more difficult to move forward. Many companies will be able to adapt to the new competitiveness challenge by substituting foreign for U.S. labor. Thus, they may succeed against their competition, but without U.S. workers.

The current competitiveness challenge has companies pitting U.S. workers against foreign workers, and companies are taking the latest technology and capital to the lowest cost labor, thereby eliminating a traditional advantage for U.S. engineers. This creates a practical problem because most of our established policy mechanisms are designed primarily to help companies. For example, increased government spending on R&D may lead to breakthroughs in nanotechnology in the United States, but the bulk of the jobs created from the design, development, and production of the resultant products may be overseas, as companies quickly or virtually transfer the latest tools, technologies, and techniques to low-cost overseas engineers.

Therefore, policy responses proposed by some business groups, such as doubling the number of U.S. engineering graduates, are not likely to be effective unless they are accompanied by substantive changes in engineering education to provide different skills than those of foreign engineers. We need different, not more, scientists and engineers. Achieving this will be much more difficult than most people realize, but it is time we begin to talk about the best ways to respond to offshoring.

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