Globalization, Offshoring, and Economic Convergence: A Synthesis

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Abstract

This paper discusses the impact that globalization in general and offshoring in particular have on US employment and income. Most recent discussions of offshoring (defined here as the transfer of existing jobs to foreign locations) in the press and by politicians have focused on lost US employment. Economists, in contrast, generally believe that labor markets will adjust and create new jobs to replace the lost ones. The first part of this paper documents the empirical evidence that the US economy generally has replaced the jobs that have been lost to technological change and offshoring activity.

Stipulating that lost jobs will be replaced, the key question then concerns the quality of the jobs, specifically the wage rates, that will apply in a globalized world. The question must be posed carefully, however, since different meanings of globalization may lead to very different answers for the possible convergence of incomes. Finally, the paper considers whether national economic policy can influence the outcome, as an application of the New Trade Theory, with comparative advantage an endogenous variable.

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1. Introduction

The impact that globalization has, and will have, on the US economy continues to be one of the most debated economic issues of our time. Globalization, of course, is a very broad term; I use it to refer to changes leading to the freer flow of goods, services, and factors of production between countries. Economists, generally speaking, view such globalization as highly beneficial, based on the international benefits of free trade. At the opposite extreme, globalization is commonly opposed by workers in industries and at firms whose jobs are being transferred to foreign locations.[1] While these workers have a self-interest in keeping their jobs, economists (as a group) also have a vested interest in determining that basic economic forces are benevolent. In the middle, journalists and other interested and neutral observers, seeing both sides of the issue, are often perplexed and unsure what to conclude.

The primary goal of this paper is to assemble the materials for a brief that would allow this middle group—the journalists and interested observers--to understand the key policy issues that globalization and offshoring raise. In good part this means asking the right questions and focusing on the right issues. As a core example, many recent press discussions have focused on the number of jobs lost to offshoring (here interpreted as the form of globalization in which existing US jobs are transferred abroad). Actually, the evidence is strong, as given in Part 2 of this paper, that such job losses are generally transitory. Thus, lost jobs cannot be a fundamental argument against offshoring, although a strong case can still be made to support policy initiatives for unemployment benefits and worker retraining.

[1] Globalization is also opposed by those fearing that it creates worse working conditions in developing countries or increases environmental damage. This paper focuses only on the impact of globalization on employment and wage levels in the US.

Income should be the issue of true concern, focusing on such questions as whether the replacement jobs have significantly lower wage rates. This concern has heightened as offshoring activity moves beyond manufacturing, now reaching such high-paying jobs in high-tech services as computer programmers. International trade theory has always considered the impact that free trade could have on wage rates and national incomes. Recently, attention has been focused even more on trade theory due to the publication of the book *Global Trade and Conflicting National Interests* by Ralph Gomory and William Baumol [2000], the paper "Where Ricardo and Mill Rebut and Confirm Arguments of Mainstream Economists Supporting Globalization" by Paul Samuelson [2004], and the forthcoming paper "The Muddles over Outsourcing" by Jagdish Bhagwati, Arvind Panagariya, and T.N. Srinivasan [2004]. As these titles all suggest, trade theory is highly relevant to the questions at hand. However, the models are all "delicate" in the sense that subtle changes in the question posed can lead to a major change in the answer provided. In Part 3 of this paper, I apply trade theory to answer the questions raised by the offshoring phenomena for US income levels.

The above trade theory papers all raise the possibility—that is, they identify conditions under which—rising productivity and technological innovations among US trading partners could seriously challenge our world leadership in high-tech industries, even creating an absolute decline in our income levels. The discussion in Part 4 takes up the issue, confirming that the conditions required for falling income levels could well occur over, say, the next 25 to 50 years. Fortunately, US policy actions can also influence the likely outcome, and the paper concludes with a discussion of these options.

2. Job Losses Are Transitory

Job losses have become the primary metric in press and public discussions of offshoring. Economists, in contrast, generally believe that labor markets equilibrate rapidly, and that most workers who lose jobs to offshoring are soon re-employed. One explanation for the divergent views is that the *job loss events necessarily come first and often reflect large layoffs*, while the re-employment of workers occurs later and often one job at a time. It is not surprising therefore that the job loss, but not the subsequent rehiring, captures press attention.

A second factor creating divergent views is that the job replacement process is not readily observable. It seems, as Adam Smith noted, to be the work of an Invisible Hand, which may be no more convincing than is the Tooth Fairy to real-world observers who plainly see the job losses. But even if economists cannot display the process, we should be able to document the resulting job renewal. With this goal, several alternative data sets are now discussed.

2.A Macroeconomic Evidence of Jobs Recovered from Technological Change

The increase in average worker productivity—here meaning Gross Domestic Product (GDP) per worker—is among the most dramatic US macroeconomic phenomena of the post World War era. This is illustrated in Figure 1, which shows US real GDP and US employment as index numbers starting at 1.0 in 1948. Over the ensuing 56 year period, real GDP rose 655% cumulatively, while employment grow 258% cumulatively, so that real GDP per worker grew 254%. The annual compound growth rate of GDP per worker was 1.68%. This remarkable record is attributable to many factors, including the growth in other inputs (both physical and human capital) and technological and management advances. The results do not directly depend on offshoring, since imported goods are a debit against GDP. However, offshoring may contribute indirectly by allowing the existing factors of production to be efficiently reallocated.

Figure 1: US Employment and Real GDP, Index 1.0 = Quarter 1, 1948

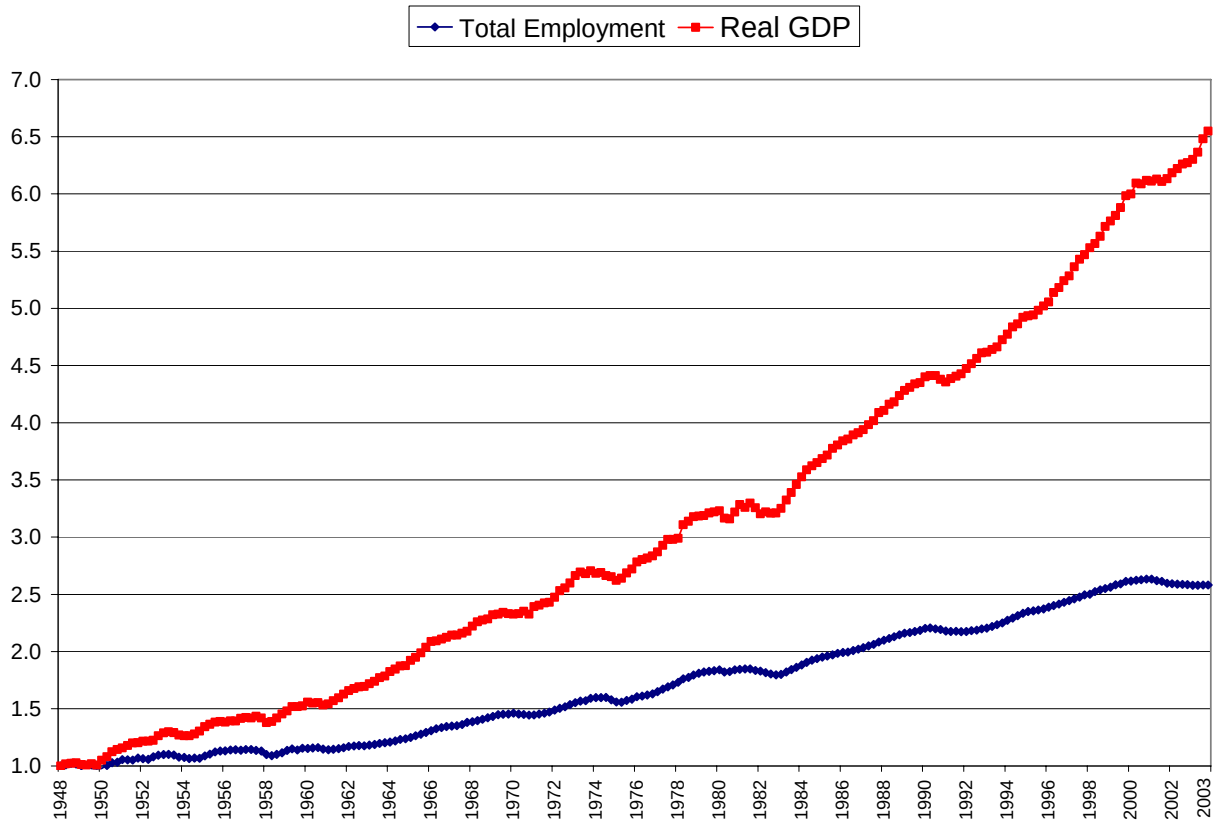
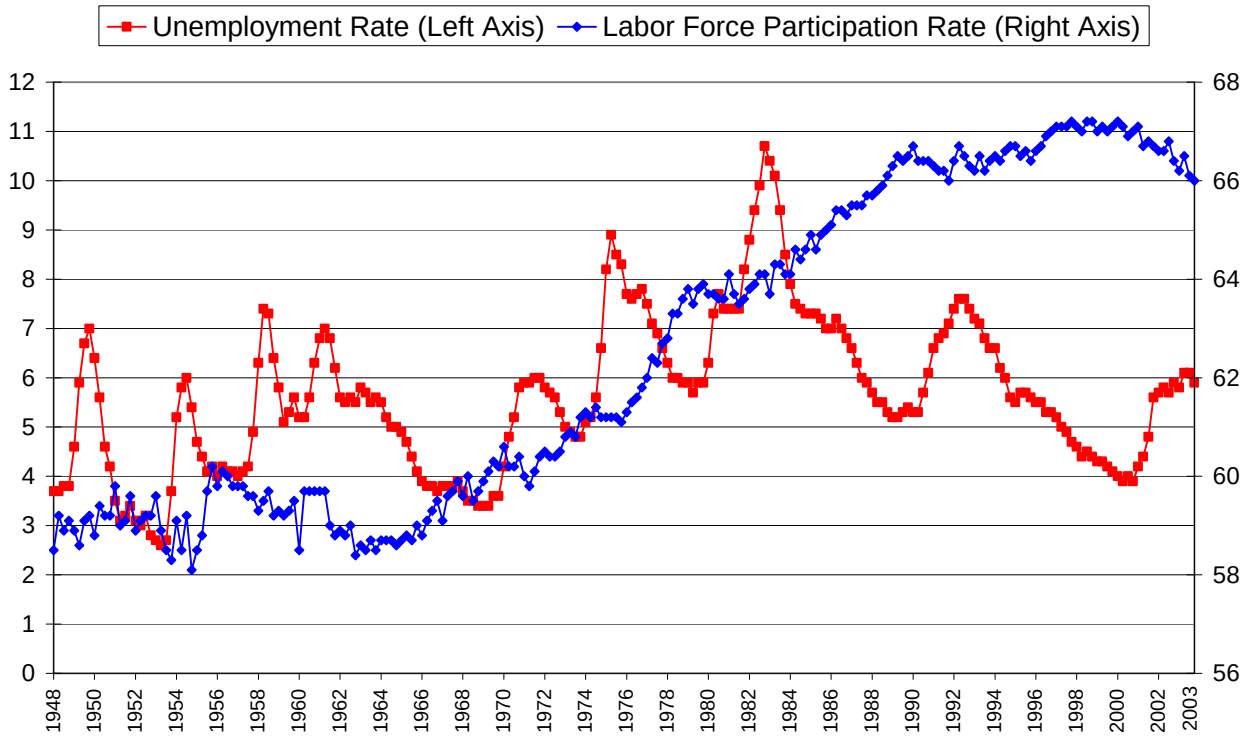


Figure 2: US Unemployment and Labor Force Participation Rates (In Percent)



The productivity increases reflected in Figure 1 were not necessarily considered positive developments when they actually occurred. In fact, by the early 1960s, there was widespread public concern that a new wave of automated factories doomed US manufacturing workers to a jobless future, in a fashion parallel to the current concerns over offshoring.[2] A pessimistic view, for example, would have interpreted the 1.68% annual growth rate in GDP per worker as rendering 1.68% of workers unemployed each year. Had this continued unabated for the 56 years of our sample, most of the US labor force would have been unemployed by 2003.

While the anticipated automation of US manufacturing did occur, the feared unemployment effects did not.[3] Figure 2 shows there has been no trend in US unemployment rates over the time span; the 6% unemployment rate in 2003 is the same level as in 1949 (and only slightly above the period-long average of 5.64%). It could be countered that, sooner or later, all these workers left the labor force, either because they become disillusioned or they just retired. Figure 2 also shows, however, that the labor force participation rate has trended steeply upward over the time period, implying that increasing numbers of disillusioned workers are not observable in these data. Similarly, retirement, even early retirement, cannot be masking an unemployment problem: even with retirements, the labor force is steadily expanding, so a significant net loss of job opportunities would have to be reflected in a rising unemployment rate.

To be sure, other macroeconomic factors also influence the unemployment and labor force participation rates, and in principle could obscure a link between technological change and unemployment. Given the power of a 1.68% compound annual growth in GDP per capita,

[2] For example, John F. Kennedy used jobs lost to automation as a major campaign issue in 1960, which led to legislation creating the Manpower Training Act.

[3] Of course, layoffs remain a common event in US labor markets. Kletzer [2001], summarized in Kletzer [forthcoming], provides a highly useful and detailed analysis of unemployment from 1979 to 1994 in manufacturing industries, with special reference to the re-employment experience of workers displaced from import competing industries. Such layoffs not withstanding, pools of unemployed workers have not accumulated.

however, labor market effects would surely stand out if technological advances really created lasting unemployment. Thus, I conclude that the displaced workers found new employment rapidly enough so that no macroeconomic trace remains in the unemployment statistics.[4]

Another possible counter to my evidence is to argue that offshoring and technological change are not the same thing, so that the observed benign impact of technological change on total employment need not apply to offshoring. In a moment, I will show that the available offshoring evidence also shows no net employment loss. First, however, I want to note the observational equivalence that exists between technological change and offshoring activity, implying that comparable employment effects should not be surprising. Paul Krugman [1993, p 24] has made this point with a parable originally from Ingram [1983]:

> "He imagines that an entrepreneur starts a new business that uses a secret technology to convert US wheat, lumber, and so on into cheap high-quality consumer goods. The entrepreneur is hailed as an industrial hero; although some of his competitors are hurt, everyone accepts that occasional dislocations are the price of a free-market economy. But then an investigative reporter discovers that what he is really doing is shipping the wheat and lumber to Asia and using the proceeds to buy manufactured goods—whereupon he is denounced as a fraud who is destroying American jobs. The point of course is that international trade is an economic activity like any other and can indeed usefully be thought as a kind of production process that transforms exports into imports."

Robert Feenstra [1998, p. 32] in his work on the impact of offshoring, developed a more formal analysis that concludes "… globalization has an impact on employment and wages that are *observationally equivalent* to the changes induced by technological innovation" (sic, italics in original).

[4] I also tested a regression of the change in the unemployment rate against the growth in GDP/worker (both current and lagged), with the result that higher growth rates in GDP/worker significantly ***lower*** unemployment rates. This result, however, may also reflect a spurious element, if firms "hoard" labor in the early stages of a recession, causing measured GDP/worker to fall at the same time that the recession is raising the unemployment rate.

2.B Jobs Lost to Recent Offshoring of Service Sector Jobs

The analysis has so far focused on the displacement of production workers. The current discussions of offshoring, however, focus on service sector jobs, in occupations ranging from call center operators to computer software engineers. An immediate question is whether service sector employees find it more, or less, difficult to become re-employed after layoffs. There is reason to think that service sector workers have more flexibility in achieving re-employment due to the generally (i) higher level and (ii) less specific form of their skills. For example, it would seem harder to re-employ a steel worker than a call center operator or a software engineer. This flexibility of service sector workers is consistent with the results of Amity and Wei [2004], who tested for US employment effects from the offshoring of services between 1992 and 2001. They find significant losses of employment when their data are deeply disaggregated (to 450 industries), but these effects disappear when they consider a higher aggregation (100 industries). This suggests that displaced service sector workers are readily moving to similar industries.

Research on the employment effects of offshoring, including Amity and Wei, generally uses industries as the unit of observation. The current wave of service sector offshoring, however, is primarily based on *occupations*, in contrast to the offshoring of manufacturing goods in earlier periods which was primarily based on *industries*. As an example, the 1980s and1990s saw the offshoring of silicon chip manufacturing from the US to Asia, which caused a large part of the industry, covering a wide range of occupations and tasks, to move abroad. Today, in contrast, the offshoring of service sector jobs is focused on particular occupations, such as call center operations and software engineers, with no suggestion that an entire industry is being moved. Indeed, the evidence suggests that the majority of the offshored service sector jobs are actually located within manufacturing enterprises and industries.

Using the concept that occupations, not industries, now move, my colleagues Ashok Bardhan and Cynthia Kroll [2003] compiled a list of service occupations "at-risk" to offshoring; see Appendix A for their latest list of service occupations and the associated number of jobs as of May 2003. Their choice of occupations at-risk to offshoring is based on such key factors as:

- No required face-to-face customer contact or direct access to home office management;
- Information and data-based services, which are adaptable to foreign workplace cultures;
- Communication requirements are readily adaptable to high-speed, broad-band, links;

It is important to stress that this list only reflects occupations "at-risk". How many jobs move abroad, and how rapidly they do so, will also depend on whether the foreign countries maintain:

- a properly skilled foreign labor force;
- significant wage differentials;
- sufficient foreign infrastructure, including structures and broad-band lines;
- appropriate business climate, including protection of data and intellectual property.

A summary tabulation of employment in at-risk job categories, 1999 to 2003, is provided in Table 1 based on the Occupational Employment Statistics (OES) of the BLS. It starts in 1999 because that was the first year the OES used the new OMB Standard Occupational Classification (SOC) system. By focusing on the at-risk share of total employment, I control for business cycle changes in total employment. The main point demonstrated in the table is that the at-risk share of total employment steadily rose over the 1999 to 2003 time period. Assuming that dislocated workers prefer re-employment in their initial occupation, these data suggest that workers in at-risk occupations had a more favorable re-employment experience than did the dislocated workers in all other occupations. The data also suggest that the number of jobs in at-risk occupations would have been decidedly rising were it not for the recession.

Table 1	Employment in At-Risk and Total Occupations, 1999 to 2003					
Occupations [1]	**Code**	**1999**	**2000**	**2001**	**2002**	**(May) 2003 [2]**
Business/Finance Support	13-xxxx	1,996,550	2,138,510	2,153,480	2,198,750	2,290,970
Computer and Mathematica	15-xxxx	2,620,080	2,932,810	2,825,870	2,772,620	2,827,010
Graphics/Design/Writing	17-, 27-xxxx	317,430	334,990	341,840	349,710	358,680
Office Support	43-xxxx	8,639,510	8,729,670	8,637,900	8,594,520	8,586,050
Medical/Legal/Sales	Misc	936,630	910,630	883,390	885,740	881,690
Total At-Risk Employment		14,510,200	15,046,610	14,842,480	14,801,340	14,944,400
Total Employment, All Occupations		127,274,000	129,738,980	127,980,410	127,523,760	127,567,910
At-Risk Employment as Share of Total		11.40%	11.60%	11.60%	11.61%	11.71%
Source: Occupation Employment Survey (OES), Bureau of Labor Statistics						
Notes:						
1) At-Risk occupations are based on those identified in Kroll [2004] and Bardhan and Kroll [2003].						
See Appendix A for specific occupations included in each summary category						
2) Through 2002, the OES data are benchmarked to a fourth quarter reference period.						
Staring with 2003, semi-annual surveys are carried out in May and November.						
The November 2003 data are just being released and will be included in a revised version.						

Three possible caveats should be noted:

1) In two of the categories, Office Support and Medical/Legal/Sales, employment as a share of total employment declined 1999 to 2003. Indeed, a comparable computation carried out for each of the individual occupation codes shown in Appendix A reveals many such examples. This is not surprising, since we know that jobs in these occupations were lost to offshoring over this period. The key question concerns the access these laid-off workers had to new jobs in either their initial or another at-risk occupation. The relative employment growth shown in Table 1 suggests that, when considering the opportunities of dislocated workers looking for re-employment in their initial occupation, the likelihood of success should be greater for workers initially in the at-risk occupations than in all other occupations.
2) It is possible that the relative growth in at-risk employment only reflects a shift in employment across industries. That is, we could observe the relative growth in at-risk employment for the aggregate, even though the at-risk employment share is falling in each

industry, if the fastest growing industries also had the highest initial at-risk employment ratios. To test for this possibility, I recomputed the 2003 at-risk employment assuming that total employment in all industries had grown at the national average.[5] The results showed a positive, albeit negligible, increase in the recomputed at-risk employment, indicating that the actual aggregate results are not driven by industry effects.[6]

3) It is possible that the relative job growth in the at-risk categories would have been still higher were it not for the negative influence of offshoring. This could well be the case, but presumes the goal is to expand employment in the at-risk occupations, not just to maintain the existing employment opportunities. Given that offshoring is a market signal that future growth in these occupations may be limited, it might be considered a good thing to dissuade workers from switching from other occupations to the at-risk occupations.

2.C Other US Labor Market Data

A recent US Government Accounting Office Report (GAO [2004]), with the goal of evaluating the effects of services job offshoring on the US economy and employment, concluded that very little useful information was available from government agencies. The one partial exception is the Labor Department's Mass Layoff Survey (MSL), which is a Federal-State cooperative statistical effort to track layoffs at firms with at least 50 employees and at least 50 initial claims for unemployment insurance filed within a 5-week period. Due to these constraints, the survey covered, in 2003, only 4.6% of all US establishments and only 56.7% of all US

[5] Because the OES survey switched from SIC industry codes to NAICS industry after 2001, I had to carry out this computation in two sub-periods, the first from 1999 to 2001 and the second from 2002 to 2003. The computed at-risk employment numbers exceeded the actual numbers in both cases.

[6] It would not necessarily be a problem even if the aggregate results were a function of industry-specific growth patterns. For example, it is possible that industry growth is itself endogenous and positively related to a large share of employment in at-risk occupations, so the result would be reflecting fundamental economic forces.

workers. The survey is unique, however, in that since 1996 it has included "overseas relocation" has a reason for layoffs. Concerned that some respondents were not properly checking this reason, the survey began in January 2004 to ask even more detailed questions on relocations.

The survey results since 1996 for Overseas Relocation are shown in Table 2. Less than 1% of all mass layoffs reported to the survey were generally attributed to overseas relocations. The distinctly higher value for the Q1 of 2004 may be attributed in part to better reporting within the revised survey. Nevertheless, it still appears that important categories of jobs lost to offshoring are not captured in the survey. The quantitative degree of underreporting could be extensive, since independent counts of documented layoffs due to oversea relocations appear to exceed by a large margin the BLS numbers (see, for example, Bronfenbrenner and Luce [2004]). As discussed in GAO [2004], this data problem is only one of many challenges for the measurement of offshoring activity. For example, there are now also serious questions whether US imports of services, which should be expanding due to offshoring, are being accurately counted.[7]

Table 2: Overseas Relocations Among Mass Layoffs

	Total Mass Layoffs Separations	# Due to Overseas Relocations	% Overseas Relocations
1996	1184355	4326	0.37%
1997	1146115	10439	0.91%
1998	1227573	8797	0.72%
1999	1149267	5683	0.49%
2000	1170427	9054	0.77%
2001	1751368	15693	0.90%
2002	1546976	17075	1.10%
2003	1503235	13205	0.88%
1st Quarter 2004	239361	4366	1.82%

Source: Mass Layoff Statistics, Bureau of Labor Statistics

[7] The Brookings Institution sponsored a conference on this issue in April 2004. See http://www.brookings.edu/pge/offshoring.htm for the agenda and conference materials.

Table 3 Gross Job Gains and Losses (Thousands of Jobs)									
	A. Total Private Sector Jobs					B. Information Sector Jobs			
	Gross Gains	Gross Losses	Net Change	Net Loss Rate		Gross Gains	Gross Losses	Net Change	Net Loss Rate
1993	29598	26984	2614			650	610	40	
1994	30809	27589	3220			739	634	105	
1995	31343	29017	2326			791	716	75	
1996	32490	29895	2595			857	705	152	
1997	33714	30765	2949			892	777	115	
1998	34625	31794	2831			952	847	105	
1999	35505	32903	2602			1087	881	206	
2000	35084	33243	1841			1161	941	220	
2001	32451	35574	-3123	-8.78%		921	1217	-296	-24.32%
2002	31643	32110	-467	-1.45%		748	972	-224	-23.05%
2003	30074	30204	-130	-0.43%		640	746	-106	-14.21%
	C. Goods Sector Jobs					D. Service Sector Jobs			
	Gross Gains	Gross Losses	Net Change	Net Loss Rate		Gross Gains	Gross Losses	Net Change	Net Loss Rate
1993	7828	7445	383			21770	19539	2231	
1994	8051	7313	738			22758	20276	2482	
1995	7954	7681	273			23389	21336	2053	
1996	8003	7636	367			24487	22259	2228	
1997	8315	7735	580			25399	23030	2369	
1998	8158	7807	351			26467	23987	2480	
1999	8205	8133	72			27300	24770	2530	
2000	8004	8062	-58	-0.72%		27080	25181	1899	
2001	7083	8695	-1612	-18.54%		25368	26879	-1511	-5.62%
2002	6835	7774	-939	-12.08%		24808	24336	472	
2003	6619	7281	-662	-9.09%		23455	22923	532	
Net Loss Rate = Net Change/Gross Losses (for years with negative net change)									
Source: Business Employment Dynamics statistics, BLS.									

The Labor Department's Business Employment Dynamics (BED) statistics provide another useful indicator of labor market activity, although without any special reference to offshoring. This source has tracked gross job gains and gross job losses, as well as the net change in employment, since 1993 for about 98% of all US employment. A summary is shown in Table 3. Part A shows, for the total private sector, aggregate job gains, job losses, and net change (= gains – losses). The key feature of the table is the large magnitude of the gross gains and losses relative

to net changes, implying a very high degree of liquidity in the US labor market. Furthermore, the net loss rate--computed as the net change divided by the gross losses in years with a negative net change--indicates that even in recession years with a net loss of jobs, the net loss remains a small percentage of the gross losses (peaking at 8.8% in 2001).

Panel B of the table applies the same format to what the survey defines as the Information Sector. This is instructive because here we see a much larger net loss rate, reaching almost 25%, no doubt as a result of the Dot-Com bust and recession. Panels C and D of the table apply the same format to jobs in the Goods and Services sectors of the economy respectively, the sum of which equals the total shown in Panel A. It is interesting here that the net loss rates from 2001 to 2003 for goods sector jobs vastly exceed the comparable rates for service sector jobs, consistent with the view that service sector workers more readily find new jobs.

2.D Job Loss Insurance and Worker Retraining

The data reviewed in the previous sections indicate that job losses, most importantly service sector job losses, do not lead to measurable and sustainable increases in macroeconomic unemployment rates. At the individual level, of course, there must be dislocations, since the benefits of international trade are obtained exactly by relocating resources. This process is what Schumpeter [1942] called “Creative Destruction”, or what Rodrik [1998, p. 6] refers to in a more modern idiom “No pain, no gain!”. US policy has long responded to this pain, creating programs for unemployment insurance and worker retaining (starting with Kennedy’s Manpower Training Act of 1962). Since 1974, special assistance has been given to workers displaced by imports under the Trade Adjustment Assistance (TAA) program. This TAA program was significantly extended further in 2002, adding the following key features (see GAO [2004b]):

- A comparable NAFTA assistance program was integrated into TAA;
- Income support was extended to 78 weeks, but requires enrollment in a training program;
- Secondary workers who supply parts to a firm directly affected by trade are now eligible;
- Workers affected by a shift of production to foreign countries are now eligible for first time;
- Health coverage tax credits were added;
- Wage insurance for older workers was introduced;
- The overall act was extended through 2007.

Nevertheless, serious issues remain. The existing Act is commonly interpreted to apply only to manufacturing workers, although there are now law suits and new proposals with the goal of extending coverage to service sector workers. The current Act also does not help local communities and regions which face their own losses when local plants close. Finally, there are wage insurance proposals that would provide much wider and deeper coverage (see Kletzer and Litan [2001] and Brainard and Litan [2004].

3. Labor Income Effects of Globalization and Offshoring

We next turn to the basic issue for globalization and offshoring, namely the impact on wages and income. We begin with a review of the international trade literature, then turn to some new empirical data.The trade theory literature has created a large inventory of models that vary in the number of goods, factors of production, countries, and technologies that are considered, among other things. The purpose of the discussion here is to draw out the primary conclusions of this literature with regard to the impact that globalization and offshoring have on the income levels of the participating countries. The review in this Part starts with Ricardian single-factor and Heckscher-Ohlin multiple-factor models, then considers the special issues of offshoring and imported inputs. “New Trade Theory” models, based on scale economies, are treated in Part 4.

3.A Single-Factor, Ricardian, Models

Singe factor models are a convenient place to begin because the recent work on trade theory referred to earlier, by Gomory and Baumol [2000] and Samuelson [2004] both use this model. I start with the 2-goods, 2-country, model as given by Samuelson [2004], which includes the condition that consumption is split evenly among the goods in each country. Assume initially that international trade is not allowed to occur, so that the national income of each country is determined by only its own productivity in producing the two goods. If we think of the two countries as U (for US) and A (for Asia), and assume U initially has higher productivity in both goods, then the national income in U will initially be higher as well.

3.A.1 Free Trade Dominates No Trade

Now allow free trade to occur. We obtain, of course, the standard result that each country specializes in the good in which it has a comparative advantage—meaning a higher relative productivity—and *unambiguously the national income in both countries will rise*. Intuitively, free trade allows the residents of each country to (i) purchase the goods that are now imported at a lower (real) price and (ii) to export produced goods at a higher price, creating an unambiguous increase in real income. This result, moreover, generalizes to cases with many goods, many factors, and many countries (Samuelson [2004, p. 143]). Two caveats, however, should be noted:

1) The comparison is sharply made between no trade and free trade. This leaves open the question how income changes when free trade already exists, but there is a further change, such as a change in the available technology in one or the other of the countries.

2) The result assumes one production factor, so that the national income and the factor's income are one and the same. This leaves open the question, with multiple factors of production, whether the introduction of trade might cause income to fall for one or more of the production factors.

3.A.2 Productivity Changes Have Diverse Impacts on National Income

The next question, with key relevance to offshoring and globalization, asks how the free trade equilibrium changes when the technological productivities available to individual countries change. A positive, and perhaps intuitive, conclusion would be that rising productivity, in any good and in any country, has the unambiguous effect that it raises income in all countries. This unfortunately is not the case, and clarifying the exceptions is one of the main messages of the Gomory and Baumol and the Samuelson contributions noted here.[8] The cases most relevant to the current issues of offshoring and globalization consider the effects on income when productivity rises in the developing country (A). The key conclusions are the following:

1) The developing country (A) generally benefits from increases in its own productivity, but there is even a special case in which rising productivity can lead to an actual decline in the country's income. This case is termed self-immiserizing growth and has been emphasized in the work of Bhagwati, including Bhagwati, Panagariya, and Srinivasan [2004]. It can arise if the productivity improvement creates such a large decline in A's terms of trade that it's real income actually falls. While a theoretical possibility and one that cannot be ruled out in the future, this problem has not been raised as a practical issue by the countries that are the current recipients of the jobs being relocated due to offshoring.
2) When the productivity increase in the developing country A occurs in the production of a good initially *imported* by the developed country U, then U will also generally benefit from the technological advance in A. The intuition here is that a decline in the price of the goods that U is already importing will raise the real income of U.

[8] Gomory and Baumol [2000] provide a useful history of the development of the trade theory that analyzes the impact that an improvement in a country's productivity has on the national income of the trading countries.

3) When the productivity increase in the developing country A occurs in the production of a good initially *exported* by the developed country U, then U may suffer a loss of real income.[9] The applicability of this result, however, is tempered by two points: (i) if there is no change in the location of production, then there is no effect; and (ii) the result may not apply to offshoring activities in which only one component of the overall production process for the good is transferred from U to A. We return below to the issues raised by the offshoring of inputs.

4) Finally, I consider the case where the productivity increase in the developing country A occurs in the production of a good initially nontraded. This case is emphasized by Bhagwati, Panagariya, and Srinivasan (BPS) [2004] as the relevant one for the recent wave of offshoring. [10] The BPS point is that recent technological changes have allowed services ranging from call center operators to computer programmers to enter into international trade for the first time. This is an explicit case of occupations being transformed into service industries and becoming available for trade. BPS conclude that "there is a strong presumption that outsourcing that turns previously nontraded services into…tradable services is beneficial to the United States." The qualifier is that any terms of trade effects not be too adverse, a condition they expect to hold in the present context.[11]

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[9] Samuelson [2004] illustrates this possibility with an intuitively understandable special case in which the productivity improvement in the developing country A is such that no trading opportunities exist between the two countries after the switch. The developed country U may still have an absolute productivity advantage, but there is simply no comparative advantage one way or the other. In this case, the national income in U reverts to the no trade value, which is to say all of the gains from trade are now lost. The developing country A is better off in this no trade position than it was in the initial no trade situation, since it now has the benefit of its higher productivity.

[10] Productivity changes in nontraded goods are not treated by Gomory and Baumol [2000] or Samuelson [2004].

[11] All the trade models analyzed by BPS include multiple factors of production, which I take up in the following section. I included their case of technological change in the nontraded good here because it is completes the taxonomy of cases. I believe that their quoted conclusion would hold equally well in a single factor model.

3.B Multi-Factor, Heckscher Ohlin Models

Multi-factor models add capital and/or distinguish between skilled and unskilled labor inputs. These models raise the possibility that trade, while it will still raise the national income measured in a suitable way, may cause the real income to decline for one or the other of the factors of production. This possibility has been long analyzed as part of factor price equalization, starting with Stolper and Samuelson [1941] and Samuelson [1949], with the latter providing conditions under which international trade can equalize factor income across countries, even though the factors themselves cannot cross international borders. The well-known intuition is that trade in goods can sometimes substitute for actual movements of the factors of production.

This possibility has recently received significant attention in view of the widening gap in the US between the wages of skilled and unskilled workers. The literature has focused on two alternative explanations for the change in the wage structure, (i) technological change, which could raise the demand for skilled relative to unskilled labor, and (ii) international trade, which may drive down the relative wages of unskilled labor as an application of international factor price equalization. Initially, studies found technological change in the US to be the primary source of the changing wage structure (see Berman, Bound, and Griliches [1994] and also Slaughter [2000] for a literature review). The results followed from the insight that the increased demand for skilled labor was occurring systematically within all industries, suggesting a technological basis. An international trade explanation, in contrast, requires a selective pattern of expansion across industries depending on their initial reliance on unskilled labor. This distinction between trade and technology explanations, however, is less clear when imported inputs are considered, to which we now turn.

3.C The Special Role of Imported Intermediate Inputs

Trade in intermediate inputs (hereafter called inputs) creates a resource allocation that varies from the pattern established when trade occurs only in final goods (as assumed in the models just described). Specifically, when trade is restricted to final goods, then the location of production is determined by the overall comparative advantage for each good, even though the comparative advantage for certain stages of the production process may actually reside elsewhere. The opening of trade in inputs, perhaps due to a reduction in trading costs, then allows the reallocation of resources to occur. Of course, trade in these inputs still follows the precepts of the traditional models.[12] Comparative advantage, however, is focused on industries when trade occurs only in final goods, but is focused on occupations when trade occurs in service inputs.

To take a realistic example, consider a high-tech product in which the US has a comparative advantage due to its abundance of capital and skilled labor (hardware engineers), even though certain steps in the process could be better carried out abroad by unskilled labor (call center operators). As long as the costs of disassembling the product process remain high, the entire production process, including call center operators, remains in the US. However, as the costs of disassembly decline, there reaches the point when call centers are offshored. This reflects a fundamental change in the nature of trade, since comparative advantage now determines the location of an occupation, not an industry.

The importance of imported inputs for the US can be illustrated at the aggregate level and particularly so in specific industries. Table 4 shows a computation of the percent of US imports that are inputs, for all imports and for some of the most intensive industries, based on data in Bardhan and Jaffee [forthcoming]. For the aggregate of all US imports, about 38% were inputs in

[12] This point was emphasized recently by Samuelson [2001] and Bhagwati, Panagariya, and Srinivasan [2004]. As noted above, Bhagwati etal. also argue that recent offshoring has often covered goods previously not traded.

1997. For specific industries, the percentage is still higher, including autos (NAICS 336), chemicals (NAICS 325), and the more anonymous NAICS 333 (non-electronic machinery). The data for 2002 will soon be available, and it will be important to see if imported inputs continue to rise as a share of total imports.[13]

Table 4: US Imported Input Goods as % of Total Goods Imports, 1997

Industry	Imported Inputs (%)		Industry	Imported Inputs (%)
Total US Imports	38%		NAICS 325 Chemicals	51%
NAICS 336 Transportation Equipment	48%		NAICS 333 Machinery Not Electronic	54%

Source: Bardhan and Jaffee [forthcoming], from Bureau of Economic Analysis data.

The interaction of input imports and US employment is well illustrated by developments within the US computer industry over the decade of the 1980s and 1990s, which have been studied by Bardhan, Jaffee, and Kroll [2003]. Figure 3 shows the steady growth in computer industry shipments of manufactured goods and sales revenues for computer services, until the recession starting in 2000. Figure 4 shows that manufacturing employment in the computer industry basically declined at the same time that US shipments of manufactured computers was rising, in part due to imported inputs. Figure 4 also shows that over this period the US computer industry gained more than 6 service sector jobs for each manufacturing job it lost, and that by 2002 service jobs exceed manufacturing jobs in the computer industry by a ratio more than 3 to 1. Figure 5 shows the steadily increasing US trade deficit in manufactured computer goods, reflecting in good part imported inputs. The trade surplus in US exports of computer services is rising, though it remains only a fraction of the trade deficit in computer hard goods.

[13] Imported inputs are computed using the US input/output matrix for inputs and US trade data to determine the extent to which these inputs are imported. Also see Bardhan and Jaffee [forthcoming].

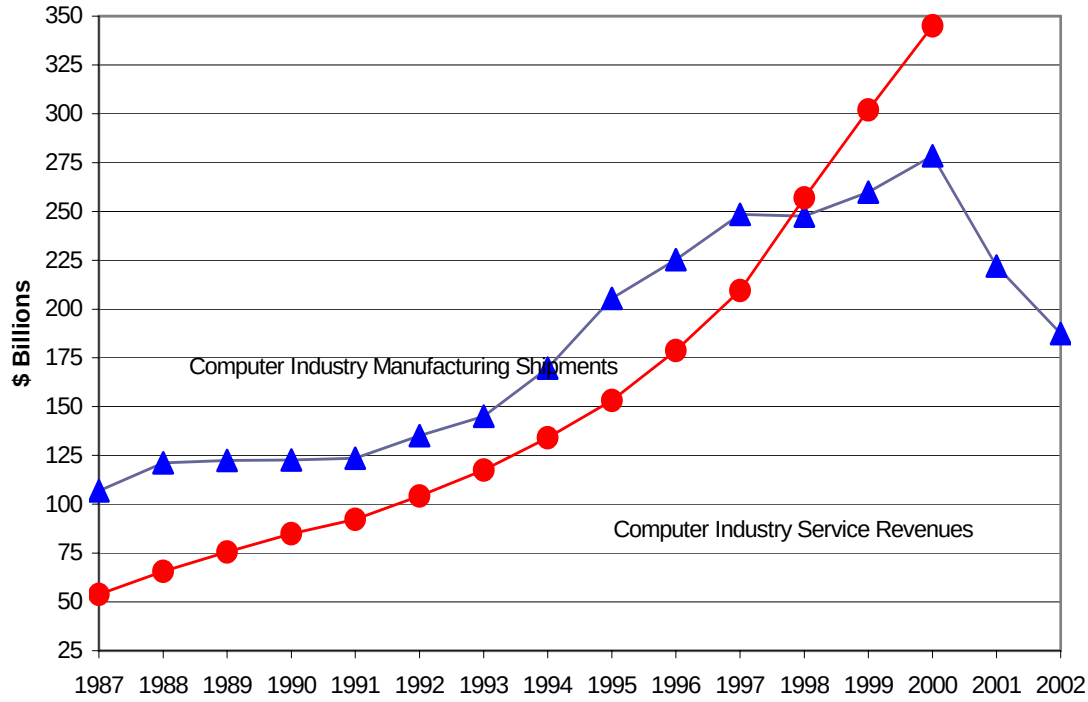

Figure 3: Computer Industry Shipments of Manufactured Good and Revenue of Services
Computer manufacturing = computers (NAICS 3341) and semiconductors (NAICS 3344).
Computer services = variety of computer design, programming, and information system tasks.
See source, Bardhan, Jaffee, and Kroll [2003], for details.

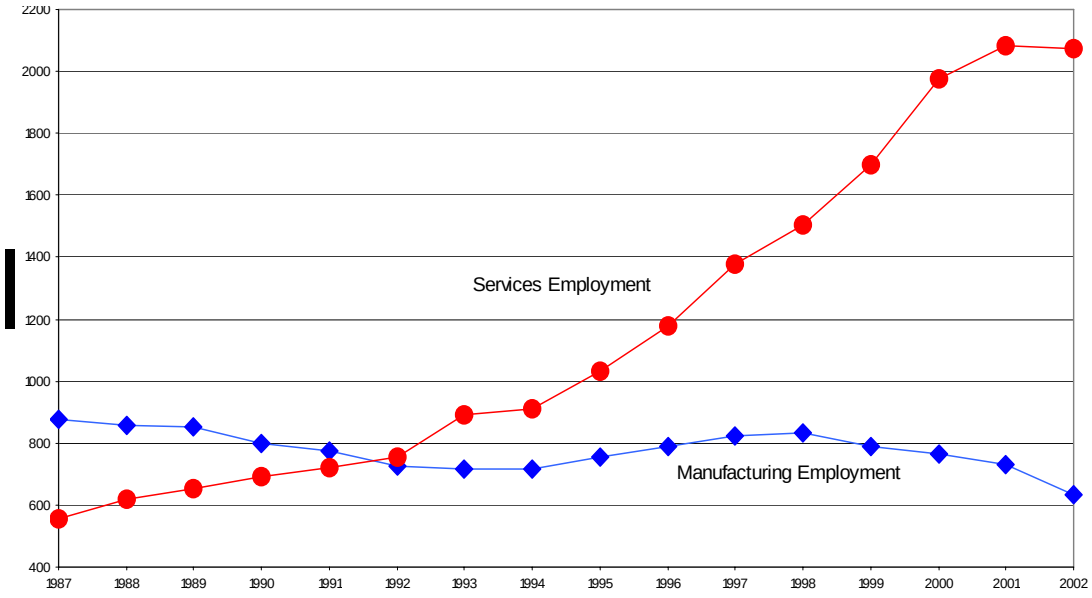

Figure 4: US Employment in Computer Industry
Computer industry defined as computers (NAICS 3341) and semiconductors (NAICS 3344).
Computer services = variety of computer design, programming, and information system tasks.
See source, Bardhan, Jaffee, and Kroll [2003], for details.

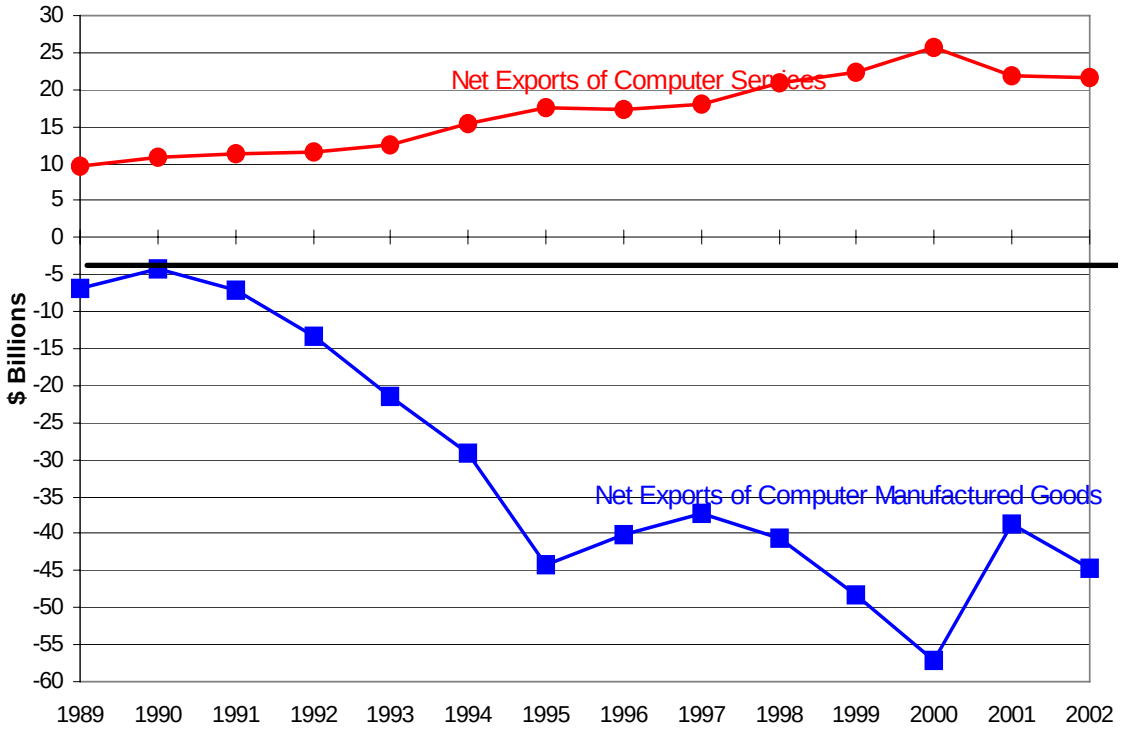

Figure 5: US Trade in Computer Industry Manufactured Goods and Services
Computer manufacturing = computers (NAICS 3341) and semiconductors (NAICS 3344). Computer services = variety of computer design, programming, and information system tasks. See source, Bardhan, Jaffee, and Kroll [2003], for details.

Another dimension of the importance of imported inputs is emphasized in the recent research of Robert Feenstra [1998], who has focused attention on the critical and perhaps unique role that imported inputs may play in understanding the falling relative wage of unskilled workers in the US. As noted earlier, the initial studies of this phenomena determined that technological change within the US was the primary source of the falling relative wages of unskilled US workers, since the increase in demand for skilled labor appeared to occur systematically within all industries, which did not appear consistent with an international trade source. Feenstra noted, however, that when it becomes economically attractive for firms to transfer the production of inputs to foreign locations, we may then observe the change occurring across a wide range of industries. Using these insights, Feenstra and Hanson [2003] argue that international trade, in the

form of trade in inputs, may play a substantially larger role in the declining relative wages of unskilled labor in the US than had been previously appreciated.[14]

With these various possibilities before us, it is worthwhile looking at one other data set that will shed light on the extent to which recent offshoring developments are affecting relative wages in the US. For this purpose, I return to the Occupational Employment Statistics (OES) of the BLS, already used in Table 1. It will be recalled that I earlier analyzed the relative employment growth for occupations judged to be at-risk to offshoring. Now I look at relative wage growth from 1999 to 2003 for the same at-risk occupations (see Appendix A for a listing of the specific occupations).

Table 5 shows that the average annual wage for all at-risk occupations rose relative to the wage for all occupations between 1999 to 2003 (from a relative value of 1.11 in 1999 to 1.15 in May 2003). To be sure, the relative wage for graphics/design/writing does fall over the period, and the relative wages of other categories fall in individual years, especially 2002. Overall, however, the wages in at-risk categories rose significantly in absolute amount in all cases, and relative to the US aggregate wages in all but one case. Combining this observation with the results of Table 1, where we saw employment growth in the at-risk category for the same period, I conclude that there is no evidence of a reduction in demand for labor in the at-risk occupations.[15] Thus, whatever the gross job losses created by offshoring over the period, the economy appears to have replaced them with new positions in the same occupations.

[14] See also Bardhan and Howe [2001] and Slaughter [2001]for further discussion of the impact of input trade on labor demand.

[15] It could be useful as well to focus on the wage bill, the product of wage rates and employment. The OES data also provide detailed distributions of wage rates within each occupation, which would provide more detailed evidence of how the wage structure is evolving.

Table 5	Average Annual Wage, At-Risk and Total Occupations					
Occupations [1]	**Code**	**1999**	**2000**	**2001**	**2002**	**May 2003 [2]**
		Wages				
All Occupations		31,571	32,890	34,020	35,560	36,210
At Risk Occupations, Total		35,035	37,724	39,162	40,380	41,486
Business/Finance Support	13-xxxx	46,934	50,049	52,559	55,517	57,775
Computer and Mathmatical	15-xxxx	54,930	58,050	60,350	61,630	63240
Graphics/Design/Writing	17-, 27-xxxx	38,999	40,742	42,023	43,268	43,419
Office Support	43-xxxx	26,966	28,741	29,791	30,561	30,951
Medical/Legal/Sales	Misc.	27,107	28,319	29,249	30,411	31,211
		Wages relative to US All Occupations				
At Risk Occupations, Total		1.11	1.15	1.15	1.14	1.15
Business/Finance Support	13-xxxx	1.49	1.52	1.54	1.56	1.60
Computer and Mathmatical	15-xxxx	1.74	1.76	1.77	1.73	1.75
Graphics/Design/Writing	17-, 27-xxxx	1.24	1.24	1.24	1.22	1.20
Office Support	43-xxxx	0.85	0.87	0.88	0.86	0.85
Medical/Legal/Sales	Misc.	0.86	0.86	0.86	0.86	0.86
Source: Occupation Employment Survey (OES), Bureau of Labor Statistics						
Notes:						
1) At-Risk occupations are based on those identified in Kroll [2004] and Bardhan and Kroll [2003].						
See Appendix A for specific occupations included in each summary category						
2) Through 2002, the OES data are benchmarked to a fourth quarter reference period.						
Staring with 2003, semi-annual surveys are carried out in May and November.						
The November 2003 data are just being released and will be included in a revised version.						

4. Long Term Options for US Comparative Advantage

The discussion in Part 3 indicates there are conditions under which technological advances and productivity increases in the developing countries that are US trading partners could cause a decline in overall US income. The possible decline in US income may be the result of two alternative mechanisms: (i) the comparative advantage in certain industries could shift from the US to the developing countries (Gomory and Baumol [2000] and Samuelson [2004]), or (ii) the offshoring of initially nontraded goods may create adverse terms of trade effects (Bhagwati, Panagariya, and Srinivasan [2004]). Whichever the source, the possible income decline is over and above any income reduction faced by individual classes of factors of production.

4.A Likely Developments over the Next Decade

The overall decline in US income is, of course, only a possibility, and the evidence reviewed in both Parts 2 and 3 suggests it is not now occurring. Furthermore, a number of factors suggest that no adverse effects on US income are likely in the near future, say over the next decade:

- The experience with the offshoring of US high-tech manufacturing during the 1980s and 1990s indicates that the process unfolds slowly over time. For example, as shown in Figure 4, the approximately 25% reduction in US computer manufacturing employment occurred over a 15 year period. Applying the 25% factor to the at-risk jobs shown in Table 1 for May 2003 yields an accumulated loss over 15 year of 3.7 million jobs, or an average of just under 250,000 jobs annually.[16] These job losses would appear small in comparison to the gross job losses the US economy suffers annually as shown above in Table 3.
- The offshoring of high-tech manufactured goods, furthermore, has assuredly been a net positive for the US economy and US income (see Bardhan, Jaffee, and Kroll [2003], Mann [2003], and Brainard and Litan [2004]).
- The current offshoring of relatively low-level service tasks, such as call center operators, not only increases the profits of US firms, but also likely leads to further growth, including the creation of new jobs in higher-level service occupations, such as computer designers. This is precisely the pattern illustrated in Figure 4 for service sector employment in the computer industry. (The question where does this end is taken up in the following section).
- The technological developments that have accelerated the service imports to the US have also accelerated service exports from the US (sometimes called "inshoring"). Bhagwati, Panagariya, and Srinivasan [2004] emphasize this point and provide a number of examples.

[16] The estimated 3.7 million job losses over 15 years about equals the value projected by Forrester Research. The approximately 15 million "at-risk" service jobs is also about the number of US manufacturing sector jobs.

4.B Risks and Opportunities Over Longer Time Spans

Focusing further into the future, however, it is no longer possible to be as assuredly optimistic that offshoring and globalization will benefit the US. The core issue is the possible loss of comparative advantage in key US high-tech industries to our trading partners. While such a loss is not plausible over the next decade, it is a relevant concern over the next 50 years. The policy issues raised by possible shifts in the location of major industries requires a special analytic framework, for which the "new trade theory" appears particularly suitable.

4.B.1 The New Trade Theory

The "new trade theory" is a framework developed by the early 1980s that analyzes the location of international trade with a focus on economies of scale (at either the firm or industry level), although traditional comparative advantage is still considered. The assumption of economies of scale also raises further issues of industrial organization including imperfect competition and differentiated products.[17] An immediate implication of economies of scale is that new firms may not be able to enter markets against an incumbent firm, due to the high fixed costs of entry. The incumbent may therefore earn excess returns simply because it arrived first. The new trade theory provides a framework for analyzing governmental international trade interventions based on the implications that economies of scale have for the value of maintaining a country's own industries and/or displacing foreign industries.

Krugman [1987], in a highly accessible and penetrating analysis of the new trade theory, describes two alternative motivations for such government intervention. The first he terms

[17] See Helpman and Krugman [1985]) for many of the theoretical underpinnings of the new trade theory, and Krugman [1987] for an accessible overall summary. The industrial organization focus of the new trade theory expanded research interest in multinational firms. The absence of multinationals in the main text discussion here reflects only the fact that the importance of these firms arises primarily at the operational level of implementing international trade.

strategic trade policy and is based on the strategic use of such tools as export subsidies and import restrictions to ensure that a domestic firm is the surviving firm in an industry. The second is based on the externalities that a firm may provide to other firms in its environment, especially if these benefits can be restricted to the home country. Investments in research and development are a particularly important source of such externalities, which leads to a focus on high-tech industries in policy discussions. Overall, the new trade theory offers a consistent framework for evaluating government interventions to facilitate the growth of US high-tech industries.

This possible role for government intervention under the new trade theory may conflict, however, with the benefits of free trade expected under traditional trade theory. The conflict is real because the new trade theory does not preclude that the traditional factors of comparative advantage are also at work, the full benefits of which require free trade. Paul Krugman in particular, although a primary creator of the new trade theory, has voiced concern that the benefits of government interventional along new trade theory lines might be exaggerated, with the cost being the loss of the more traditional advantages of free tree.

4.B.2 Some Guidelines for Long-Term Policy

Put in the sharpest terms, the issue is how should the US best go about maintaining its comparative advantage in high-tech industries. When considering how to solve issues far in the future, it is often useful to consider how they were solved far in the past. In other words, how did the US come to have such a comparative advantage in high-tech industries in the first place? Paul Samuelson [2004, p 144] briefly addressed this question:

> Historically, U.S. workers used to have kind of a de facto monopoly access to the superlative capitals and know-hows (scientific, engineering and managerial) of the United States. All of us Yankees, so to speak, were born with silver spoons in our mouths—and that importantly

explained the historically high U.S. market-clearing real wage rates for (among others) janitors, house helpers, small business owners and so forth.

Of course, this raises the question how did we obtain the silver spoon of superlative capital and know-how in the first place. The new trade theory has its own approach, which is to accept the initial position as if given by happenstance, though once these industries are established, economies of scale will make it difficult for other countries to dislodge them.

My own view is that the US dominance of these industries is more than happenstance, though I admit that in creating the following list of critical attributes I am aided by (the possibly misleading) advantage of hindsight:

1) The US maintains a long cultural tradition of honoring and rewarding invention and entrepreneurship. Even failure is often rewarded with a fresh start. These cultural and societal attributes encourage risk-taking and innovation in both invention and entrepreneurship. The development of the US venture capital industry is a case in point.
2) The US has allocated substantial resources to research and development, based on both private sector and government initiatives. The investments in fundamental research reflect a fundamental faith in the benefits of science, and the investments in development reflect a similar faith in technology. These allocations are consistent with (1) but operate on the institutional rather than at the individual level.
3) The US has allocated substantial resources to education, based on both private and governmental transfers. At the high-school and college levels, this creates a fundamentally sound basis of mass human capital. At the advanced degree and technical degree levels, this offers human capital with special skills in research and development.

4) The US has maintained a generally benign immigration policy with respect to students and technically skilled individuals (engineers, programmers, etc). This has allowed the US to augment its human capital base in a very tactical fashion.
5) The US government sets the rules for economic engagement, but has itself tried to intervene directly as little as possible. The rules of engagement include such matters as, business law, taxation, and regulatory oversight. I would also include the social safety nets, such as social security, unemployment insurance, and employment retraining programs. While the borderline cases concerning what is or is not an appropriate area of government activity are contentious, I believe there is a well defined and large area of common agreement. It is ironic, of course, that the very issue of whether the US government should intervene to maintain our international comparative advantage in key industries is such a borderline case.
6) In view of the key advantages enumerated in items (1) to (5), it is not surprising that the US has also become a location of choice for the development of innovations and discoveries that first occur abroad. Even now, as the offshoring of jobs to Asia continues, Asian entrepreneurs still indicate the US is a highly favored location to develop their newest ideas.

The above is just one list of key attributes for the US comparative advantage in high-tech industries; other observers will no doubt have additions and even subtractions. Whatever the details, it will remain noteworthy that the US is now underperforming in several of these areas, most notably R&D and education, and may be facing a backlash in immigration policy (perhaps inadvertently the result of 9/11). At the same time, the rest of the world is surely improving, in part by copying our success. So what should the US do? The simple answer is “more of the same,” since our formula is likely to continue to work in the future. But this means expanding in all the areas, especially in the R&D and education areas, to ensure we continue to set the pace.

Appendix 1: Occupations At-Risk to Outsourcing, with 2003 Employment

Code	Occupation Title	Employment
Computer and Mathematical Occupations (all codes 15-xxxx)		2,827,010
Medical, Legal and Sales		
23-2011	Paralegals and Legal Assistants	206,700
29-2034	Radiologic Technologists and Technicians	173,030
31-9094	Medical Transcriptionists	97,810
41-9041	Telemarketers	404,150
Graphics, Design and Writing Occupations		
17-1021	Cartographers and Photogrammetrists	8,940
17-3011	Architectural and Civil Drafters	97,800
27-1021	Commercial and Industrial Designers	33,390
27-1024	Graphic Designers	151,950
27-3042	Technical Writers	44,690
27-3091	Interpreters and Translators	21,910
Business and Finance Support		
13-1031	Claims Adjusters, Examiners, and Investigators	234,190
13-1051	Cost Estimators	184,620
13-1072	Compensation, Benefits, Job Analysis Specialists	86,450
13-1111	Management Analysts	423,880
13-2011	Accountants and Auditors	924,640
13-2031	Budget Analysts	55,560
13-2041	Credit Analysts	68,910
13-2051	Financial Analysts	165,420
13-2053	Insurance Underwriters	96,890
13-2082	Tax Preparers	50,410
Office Support		
43-1011	First-Line Supervisors/Managers, Office Support	1,412,470
43-2011	Switchboard Operators, Answering Service	217,700
43-2021	Telephone Operators	45,310
43-3011	Bill and Account Collectors	417,100
43-3021	Billing and Posting Clerks, Machine Operators	487,420
43-3031	Bookkeeping, Accounting, and Auditing Clerks	1,750,680
43-3051	Payroll and Timekeeping Clerks	194,330
43-3061	Procurement Clerks	72,820
43-4011	Brokerage Clerks	75,380
43-4021	Correspondence Clerks	27,460
43-4041	Credit Authorizers, Checkers, and Clerks	73,860
43-4051	Customer Service Representatives	1,902,850
43-4111	Interviewers, Except Eligibility and Loan	190,160
43-4131	Loan Interviewers and Clerks	179,080
43-4151	Order Clerks	303,320
43-4161	Human Resources Assistants, Except Payroll	165,760
43-5061	Production, Planning, and Expediting Clerks	277,030
43-9011	Computer Operators	160,170
43-9021	Data Entry Keyers	339,010
43-9031	Desktop Publishers	33,590
43-9041	Insurance Claims and Policy Processing Clerks	239,580
43-9111	Statistical Assistants	20,970
All Occupations At Risk		14,944,400
All Occupations		127,567,910
Percent At-Risk/All Occupations		11.71%

Source: Kroll [2004] and Bardhan and Kroll [2003], based on
US Bureau of Labor Statistics, Occupation Employment Statistics.

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