Globalization, Offshoring, and Economic Convergence: A Survey

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Abstract

This chapter 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 chapter 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 chapter 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 here 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) may also have a vested interest in concluding that basic economic forces are benevolent. In the middle, policymakers, 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 chapter is to assemble the materials for a brief that should allow this middle group 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). However, the evidence is strong, as provided in Part 2 of this chapter, 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 chapter focuses only on the impact of globalization on employment and wage levels in the US.

Wage rates and income levels are the proper issues of public concern, focusing on questions such as whether the replacement jobs have significantly lower wage rates. This concern has expanded as offshoring activity moves beyond manufacturing, now reaching high-paying jobs in high-tech services such 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 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 chapter, 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 chapter concludes with a discussion of these options.

2. Job Losses Are Transitory

Job losses have become the primary metric for the costs of offshoring in press and public discussions. 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 losses necessarily come first and often are part of a large layoff*, 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 II era. This is illustrated in Figure 1, which shows US real GDP and employment as index numbers starting at 1.0 in 1948. Over the ensuing 58 year period, real GDP rose 709% cumulatively, while employment grow 249% cumulatively, so that real GDP per worker grew 284%. The annual compound growth rate of GDP per worker was 1.71%. 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
(Source: Current Population Survey for Civilian Employment, Bureau of Economic Analysis for Real GDP)

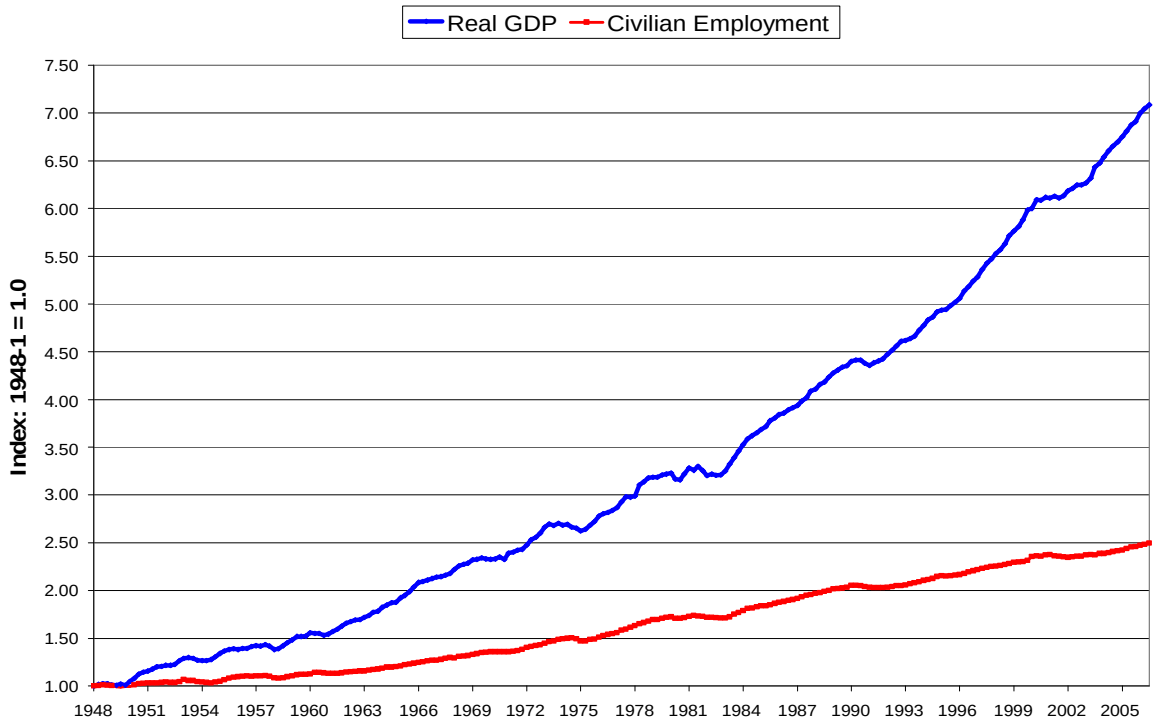
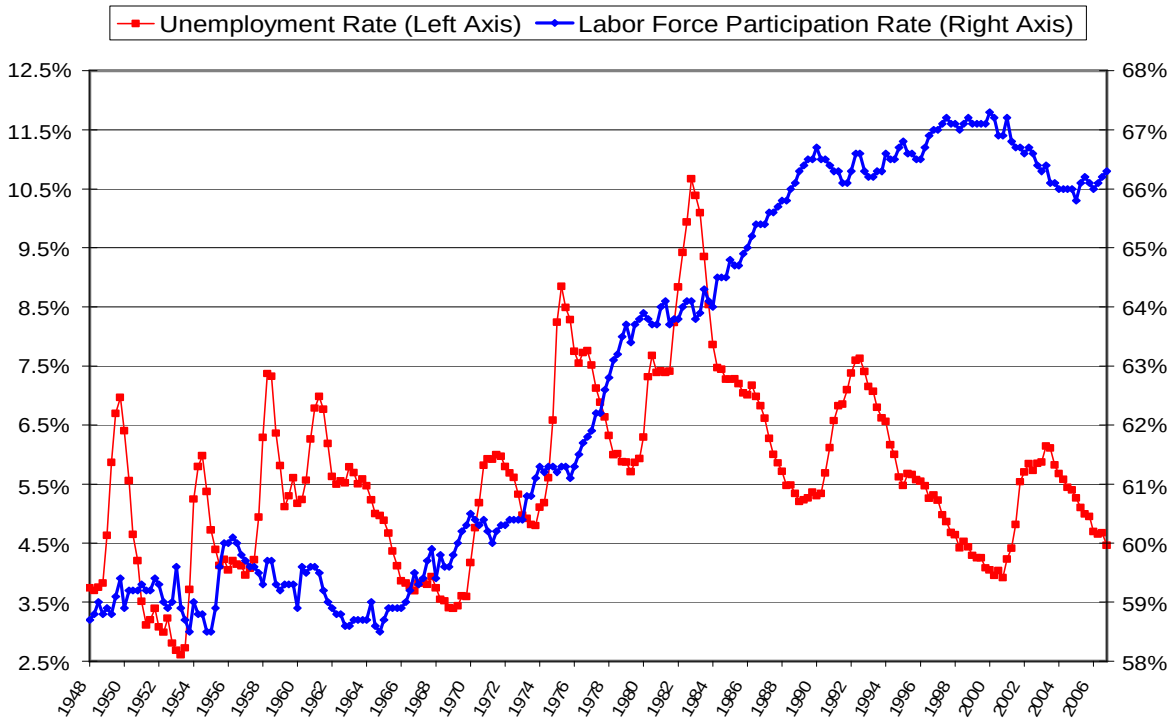


Figure 2: US Unemployment and Labor Force Participation Rates (In Percent)
(Source: Current Population Survey)



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 1.71% annual growth rate in GDP per worker as rendering 1.71% of workers unemployed each year. Had this continued unabated for the 58 years of our sample, most of the US labor force would have been unemployed by 2006.

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 4.5% unemployment rate in 2006 is well below the 7% level reached in 1949 (and is below the full-period average of 5.6%). It could be countered that, sooner or later, these workers all 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 1.71% 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. Lori Kletzer [2001], summarized in Kletzer [2004], 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 workers displaced by technology found new employment such 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 be expected. 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 also concludes from his detailed analysis of technological change and globalization: "…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 using the change in the unemployment rate as the dependent variable against the growth in GDP/worker (both current and lagged), with the result that higher growth rates in GDP/worker significantly *reduce* 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

We now focus on the impact of offshoring on service sector jobs, ranging from call center operators to computer software engineers. One positive factor for service sector workers is that they are likely to exhibit greater flexibility for reemployment after layoffs due to their generally (i) higher and (ii) less specific skills. For example, it would seem harder to reemploy a steel production 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; also see

Kroll (2006) for the latest list of at-risk service occupations. Their choice of occupations at-risk to offshoring is based on such key factors as:

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

It is important to stress that the Bardhan and Kroll 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 labor force;
- significant wage differentials;
- sufficient infrastructure, including physical and communications capital structures;
- an appropriate business climate, including protection of data and intellectual property.

A summary tabulation of employment in at-risk job categories, 1999 to 2005, 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 almost all the 1999 to 2005 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 2000 to 2002 recession.

Table 1	Employment in At-Risk and Total Occupations, 1999 to 2005							
	In Thousands of Workers							
Ar-Risk Occupations [1]	**Code**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Business/Finance Support	13-xxxx	1,997	2,139	2,153	2,199	2,291	2,377	2,482
Computer and Math	15-xxxx	2,620	2,933	2,826	2,773	2,827	2,915	2,953
Graphics/Design/Writing	17-, 27-xxxx	317	335	342	350	359	374	398
Office Support	43-xxxx	8,640	8,730	8,638	8,595	8,586	8,713	8,691
Medical/Legal/Sales	Misc	937	911	883	886	882	890	894
Total At-Risk Employment		14,510	15,047	14,842	14,801	14,944	15,270	15,417
Total Employment, All Occupations		127,274	129,739	127,980	127,524	127,568	128,127	130,308
At-Risk Employment as Share of Total		11.40%	11.60%	11.60%	11.61%	11.71%	11.92%	11.83%
Source: Occupation Employment Survey (OES), Bureau of Labor Statistics								
Notes:								
1) At-Risk occupations are based on those identified in Bardhan and Kroll [2003].								
2) Through 2002, the OES data are benchmarked to a fourth quarter reference period.								
Staring with 2003, data are from the May semi-annual survey.								

Three possible caveats should be noted:

1) In one category, Medical/Legal/Sales, total employment declined slightly from 1999 to 2005. Indeed, a comparable computation carried out at the level of disaggregated individual occupation codes 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 appears 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 at-risk employment assuming that total employment in all industries had grown at the national average. 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.[5]

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 US Government Accounting Office Report (GAO [2004a]), 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 extended layoffs at private, non-farm, firms with at least 50 employees and at least 50 initial claims for unemployment insurance filed within a 5-week period. As a result of these constraints, Brown (2004) reports that the 2003 survey covered 4.6% of all US establishments and 56.7% of all US workers.

[5] 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, in which case the results would still reflect fundamental economic forces.

Since 1996, the survey included "overseas relocation" as a reason for layoffs. The results from 1996 to 2003 indicated that a very small proportion—generally less than 1% of all extended layoffs--were attributed to overseas relocations. There was concern, however, that the low result was due to survey design, so the survey was revised in 2004 with more detailed questions on relocations. Table 2 provides the available data for 2004 and 2005 for total separations due to extended mass layoffs, including those where relocation was indicated as a source of the separation. Even with the redesigned survey, well less than 2 percent of the total separations are attributed to out of country relocations. It is quite possible, of course, that there is still substantial underreporting, since independent counts of layoffs due to oversea relocations often provide larger numbers; see, for example, Bronfenbrenner and Luce [2004]). Also, as discussed in GAO [2004a], 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.[6]

Table 2: Out of Country Relocations from Extended Mass Layoffs

	Layoff Events		Separations	
	2004	**2005**	**2004**	**2005**
Total	5,010	4,881	993,909	884,356
Total with Relocations	382	259	55,122	34,194
Domestic	270	164	36,246	21,470
Out of Country	103	91	16,197	12,030
Unassigned location	9	4	2,679	694
Out of country/Total	2.06%	1.86%	1.63%	1.36%

Source: Extended Mass Layoffs in 2005, Report 997, U.S. Bureau of Labor Statistics

[6] 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 Rate		Gross Gains	Gross Losses	Net Change	Net Rate
1993	29,598	26,984	2,614	9.7%		650	610	40	6.6%
1994	30,809	27,589	3,220	11.7%		739	634	105	16.6%
1995	31,343	29,017	2,326	8.0%		791	716	75	10.5%
1996	32,490	29,895	2,595	8.7%		857	705	152	21.6%
1997	33,714	30,765	2,949	9.6%		892	777	115	14.8%
1998	34,625	31,794	2,831	8.9%		952	847	105	12.4%
1999	35,505	32,903	2,602	7.9%		1,087	881	206	23.4%
2000	35,084	33,243	1,841	5.5%		1,161	941	220	23.4%
2001	32,451	35,574	-3,123	**-8.8%**		921	1,217	-296	**-24.3%**
2002	31,643	32,110	-467	**-1.5%**		748	972	-224	**-23.0%**
2003	30,074	30,204	-130	**-0.4%**		640	746	-106	**-14.2%**
2004	31,472	29,383	2,089	7.1%		658	714	-56	**-7.8%**
2005	31,440	29,362	2,078	7.1%		620	627	-7	**-1.1%**
	C. Goods Sector Jobs					**D. Service Sector Jobs**			
	Gross Gains	Gross Losses	Net Change	Net Rate		Gross Gains	Gross Losses	Net Change	Net Rate
1993	7,828	7,445	383	5.1%		21,770	19,539	2,231	11.4%
1994	8,051	7,313	738	10.1%		22,758	20,276	2,482	12.2%
1995	7,954	7,681	273	3.6%		23,389	21,336	2,053	9.6%
1996	8,003	7,636	367	4.8%		24,487	22,259	2,228	10.0%
1997	8,315	7,735	580	7.5%		25,399	23,030	2,369	10.3%
1998	8,158	7,807	351	4.5%		26,467	23,987	2,480	10.3%
1999	8,205	8,133	72	0.9%		27,300	24,770	2,530	10.2%
2000	8,004	8,062	-58	**-0.7%**		27,080	25,181	1,899	7.5%
2001	7,083	8,695	-1,612	**-18.5%**		25,368	26,879	-1,511	**-5.6%**
2002	6,835	7,774	-939	**-12.1%**		24,808	24,336	472	1.9%
2003	6,619	7,281	-662	**-9.1%**		23,455	22,923	532	2.3%
2004	6,861	6,645	216	3.3%		24,611	22,738	1,873	8.2%
2005	6,853	6,634	219	3.3%		24,334	22,728	1,606	7.1%

Net Rate = Net Change/Gross Losses (**bold** for years with negative net change)

Source: Business Employment Dynamics statistics, Bureau of Labor Statistics

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--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 2000 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, GAO [2006a] indicates that the data jointly collected by the states and the Department of Labor for measuring trade adjustment assistance programs is highly deficient. On a more positive note, GAO [2006b], in a case study of five traded-related plant closures, found that more than three-quarters of the displaced workers received some form of reemployment assistance, particularly personalized job search assistance. Regarding wage insurance, there are now also proposals to 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 only by 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 be correspondingly higher.

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 *the national income in both countries will unambiguously 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 negative cases is one of the main messages of the Gomory and Baumol and the Samuelson contributions.[7] 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). These cases are the most relevant because the newly created incentives for offshoring, created by globalization, have the effect that labor in the developing economies has become more productive. The key conclusions are the following:

[7] 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.

1) The developing country (A) generally benefits from increases in its own productivity, but there is even a special case in which raising its productivity can lead to an actual decline in A's income. This case is termed self-immiserizing growth in the work of Jagdish 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 its real income actually falls. While a theoretical possibility and one that cannot be ruled out in the future, this problem has not been evident in the countries that are the current recipients of offshored jobs.
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. It is intuitively sensible that a decline in the production costs, and hence the price, of the good that U is already importing will raise the real income of U.
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.[8] 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,

[8] 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.

Panagariya, and Srinivasan (BPS) [2004] as the relevant one for the recent wave of offshoring.[9] 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.[10]

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

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

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

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 rather equally across industries, suggesting a technological basis. An international trade explanation, in contrast, requires the shifts in the amount and pattern of labor demand to vary 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, as would arise from a reduction in trading costs, then allows a reallocation of resources to occur. Of course, trade in these inputs still follows the precepts of the traditional models.[11] Comparative advantage, which is based on industries when trade occurs only in final goods, becomes 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 production remain high, the entire 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 [2005]. For the aggregate of all US imports, about 38% were inputs in 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). [12]

Table 4: US Imported Inputs as % of Total 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 [2005], from Bureau of Economic Analysis data.

[11] 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.

[12] 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 [2005].

Figure 3: Computer Industry Hardware Shipments and Services Revenue.
Computer manufacturing = computers (NAICS 3341) and semiconductors (NAICS 3344).
Computer services = computer design, programming, and information system tasks.
See Bardhan, Jaffee, and Kroll [2004], for details.

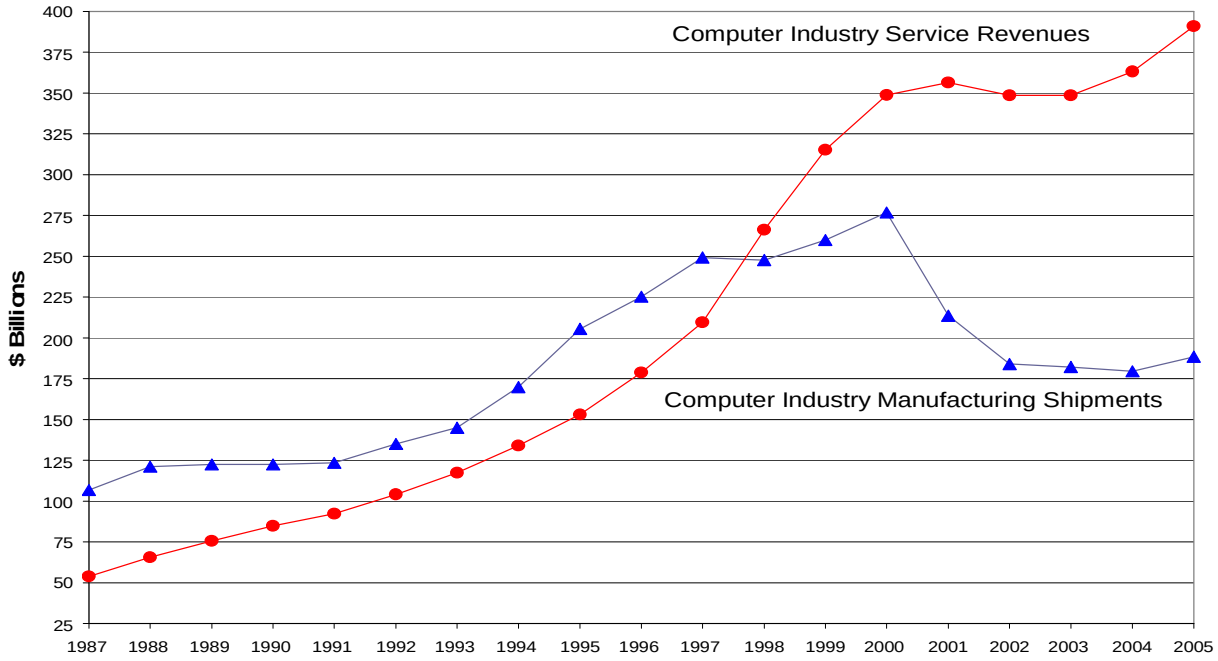
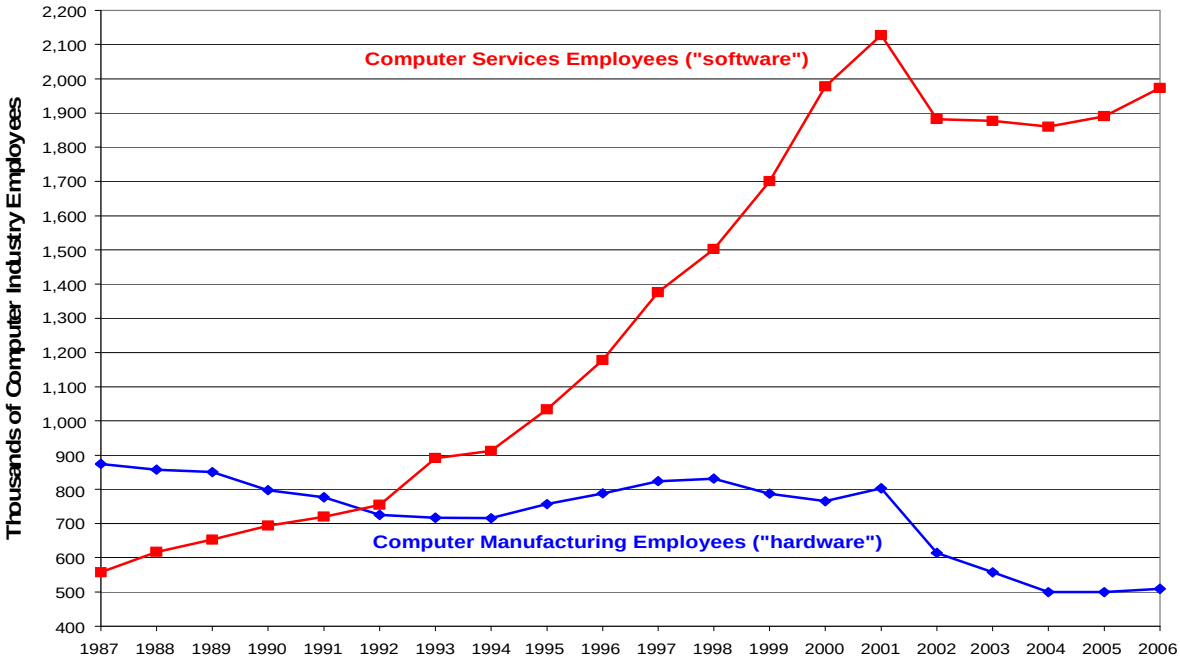


Figure 4: US Employment in Computer Industry
Computer industry defined as computers (NAICS 3341) and semiconductors (NAICS 3344).
Computer services = computer design, programming, and information system tasks.
See Bardhan, Jaffee, and Kroll [2004], for details.



The interaction of input imports and US employment is well illustrated by the US computer industry's experience over the last 20 years. Figure 3 shows the steady growth in computer hardware shipments and computer services revenue, at least until the recession starting in 2000. Figure 4 shows that the computer industry's production employment was generally declining, even though US hardware shipments were generally rising. Figure 4 also shows that over this period the US computer industry gained almost 4 service sector jobs for each manufacturing job it lost, and that by 2006 service jobs exceed manufacturing jobs in the computer industry by a ratio of almost 4 to 1. The implication is that the reduction in the costs of computer hardware, created in good part by the offshoring of computer manufacturing, has allowed the industry to grow and prosper, creating the dramatic growth in computer services employment.

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 international trade was not the primary factor, because the observed shifts in the demand for unskilled labor were not particularly distinguishable by industry. Feenstra noted, however, that when it becomes economically attractive for firms to transfer the production of inputs to foreign locations, we may then observe similar changes in the demand for unskilled labor occurring for many 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.[13]

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

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 2005 for the same at-risk occupations.

Table 5	**Average Annual Wage, At-Risk and Total Occupations**							
	Code	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
All Occupations		31,571	32,890	34,020	35,560	36,210	37,020	37,870
At-Risk Occupations [1]								
Business/Finance Support	13-xxxx	46,934	50,049	52,559	55,517	57,775	57,775	60,283
Computer and Math	15-xxxx	54,930	58,050	60,350	61,630	63,240	65,510	67,100
Graphics/Design/Writing	17-, 27-xxxx	38,999	40,742	42,023	43,268	43,419	44,502	45,260
Office Support	43-xxxx	26,966	28,741	29,791	30,561	30,951	31,775	32,598
Medical/Legal/Sales	Misc.	27,107	28,319	29,249	30,411	31,211	32,513	33,877
All At-Risk Wages		35,035	37,724	39,162	40,380	41,486	42,618	44,064
		At-Risk Wages relative to US All Occupations						
Business/Finance Support	13-xxxx	1.49	1.52	1.54	1.56	1.60	1.56	1.59
Computer and Math	15-xxxx	1.74	1.76	1.77	1.73	1.75	1.77	1.77
Graphics/Design/Writing	17-, 27-xxxx	1.24	1.24	1.24	1.22	1.20	1.20	1.20
Office Support	43-xxxx	0.85	0.87	0.88	0.86	0.85	0.86	0.86
Medical/Legal/Sales	Misc.	0.86	0.86	0.86	0.86	0.86	0.88	0.89
All At-Risk Wage Relatives		1.11	1.15	1.15	1.14	1.15	1.15	1.16
Source: Occupation Employment Survey (OES), Bureau of Labor Statistics								
Notes:								
1) At-Risk occupations are based on those identified in Bardhan and Kroll [2003].								
2) Through 2002, the OES data are benchmarked to a fourth quarter reference period.								
Staring with 2003, data are from the May semi-annual survey.								

Table 5 shows that the average annual wage for all at-risk occupations rose relative to the wage for all occupations between 1999 to 2005 (from a relative value of 1.11 in 1999 to 1.16 in 2005). 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.[14] Thus, whatever the gross job losses created by offshoring over the period, on net, the economy appears to have replaced them with new positions that provide at least comparable average wages.

4. Long Term Options for US Comparative Advantage

The discussion in Part 3 indicates that there are conditions under which technological advances and productivity increases in the developing countries who 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 that may be faced by individual 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:

[14] 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.

- 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 40% reduction in US computer manufacturing employment occurred over a 20 year period, or approximately 2% a year on average. Applying the 2% factor to the 15 million at-risk jobs in 2005, as shown in Table 1, yields an annual estimate of jobs lost to offshoring of approximately 300,000 jobs a year, which is well within the range of other current estimates of possible US job losses from offshoring.[15] Whatever the precise numerical estimate, job losses of this magnitude appear extremely small when compared to the gross job losses and gross job gains that the US economy already successfully deals with each year, 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 [2004], 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.

[15] Garner [2004] discusses the available estimates of the likely impact of offshoring on US employment.

4.B Risks and Opportunities Over Longer Time Spans

Looking 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 our comparative advantage in key high-tech industries. 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.[16] The assumption of economies of scale also raises further issues of industrial organization including imperfect competition and differentiated products. 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 strategic trade policy and is based on the strategic use of such tools as export subsidies and

[16] See Helpman and Krugman [1985]) for many of the theoretical underpinnings of the new trade theory, and Krugman [1987] for an accessible overall summary.

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 many of the rules under which the economy operates, but directly intervenes as little as possible. The economic rules cover 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).[17] 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.

[17] Blinder [2006] presents a similar view of the need to develop highly skilled human capital if the US income levels are to be maintained in the long run.

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