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# Introduction

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The U.S. Bureau of the Census recently reported that in 1997 the real median income of U.S. households returned to the peak achieved in 1989, which was the year before a short recession (U.S. Department of Commerce 1998a, v, xii). A number of specific subgroups have achieved or surpassed their 1989 income levels, including households maintained by persons 25–34 years or 55 years and older; households in the West, Midwest, and South; and households maintained by women. At the same time, the proportion of the population living below the poverty line has fallen to about the same level as in 1989, with the most recent decline in poverty experienced especially by African Americans and Hispanics (U.S. Department of Commerce 1998b, v–vi). Despite this good news, the *inequality* of income has continued to increase steadily. The share of income received by the lowest quintile (20 percent) of households fell from 4.4 percent in 1977 to 3.8 percent in 1987 to 3.6 percent in 1997, while the share of income received by the highest quintile of households has risen from 43.6 to 46.2 to 49.4 percent over the same period.

These recent developments are typical of the trends that have occurred since the U.S. economy recovered from the recession of the early 1980s: real incomes have been rising, but the rise has not been shared equally by all demographic groups or regions in the country. Indeed, there are reasons to believe that since the early 1980s there are new forces at work in the United States shaping the relationship between employment and earnings of different groups. Since that time, the United States has experi-

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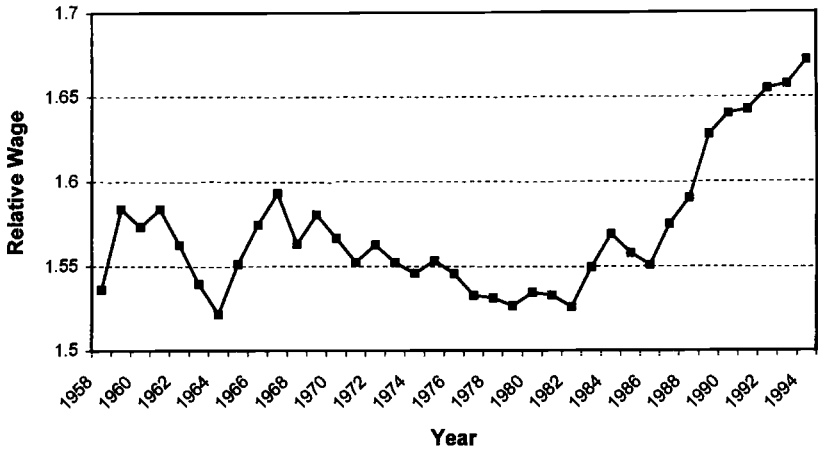


**Fig. 1 Relative wage of nonproduction/production workers, U.S. manufacturing**
*Source:* NBER Productivity Database, http://www.nber.org/nberprod.html.
*Note:* The wages of nonproduction and production workers are weighted by industry employment of these workers.

enced a fall in the wages of the lowest-skilled workers, measured either in real terms or relative to wages of high-skilled workers; a fall in the relative employment of less-skilled workers; and, as a result of both of these, an increase in the share of total labor income going to high-skilled workers.

To illustrate these trends, we can use data from the U.S. manufacturing sector for nonproduction and production workers. The former are often used as a proxy for higher-skilled workers, and the latter as a proxy for less-skilled workers. This treatment can certainly be questioned, since nonproduction workers include, for example, many people with little education. Nevertheless, the trends shown by the nonproduction and production workers have been shown to be similar to trends obtained when measuring skill by the education of workers, and also when looking beyond the manufacturing sector.[1] These trends are illustrated in figure 1, which graphs the relative wage of nonproduction/production workers, and figure 2, which graphs their relative employment.

Figure 2 shows a steady increase in the ratio of nonproduction to production workers used in U.S. manufacturing, with some leveling off re-

1. The breakdown of workers according to whether they are engaged in production activity or not is made in the U.S. Annual Survey of Manufactures and is used as a proxy for the occupational class or skill level of workers. While there are problems with using the production/nonproduction classification as a proxy for skill, there is evidence suggesting that in practice the classification shows trends similar to those found when skill categories are used (Berman, Bound, and Griliches 1994; Berman, Bound, and Machin 1998; Sachs and Shatz 1994). The increase in the wage of nonproduction workers relative to the wage of production workers is only a small part of the total increase in wage inequality between more- and less-skilled workers that occurred during the 1980s; see Katz and Murphy (1992) for a discussion.

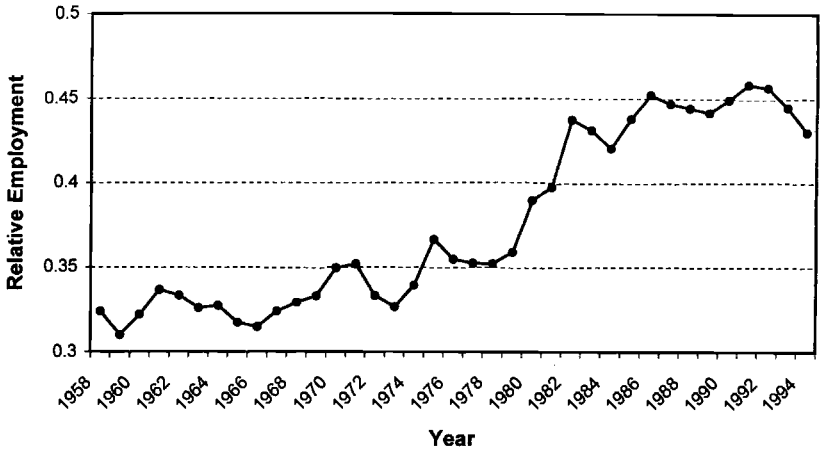


**Fig. 2 Relative employment of nonproduction/production workers, U.S. manufacturing**
*Source:* NBER Productivity Database, http://www.nber.org/nberprod.html.

cently. This increase in the supply of workers can account for the reduction in the relative wage of nonproduction workers from about 1970 to the early 1980s, as shown in figure 1, but is at odds with the increase in the relative wage after that. The rising relative wage should have led to a shift in employment away from higher-skilled workers, along a demand curve, but it has not. Thus, the only explanation consistent with the facts is that there has been an *outward shift* in the demand for skilled workers since the mid-1980s, leading to rising relative wages and employment for skilled workers.

What factors account for these changes? Most widely cited are international competition from low-wage countries and skill-biased technological change due to the increased use of computers. A large amount of research during the past decade has sought to evaluate both explanations, with the result that the latter (skill-biased technological change) is often thought to be the more important.[2] The reasons for this are twofold. First, from the Stolper-Samuelson theorem, international competition will lead to an increase in the relative wage of high-skilled workers if and only if there is an increase in the relative price of goods using these workers intensively. Since the work of Lawrence and Slaughter (1993), it has been recognized that the relative price of skill-intensive goods *did not* rise in the United States during the 1980s (although it did during the 1970s). This is the first strike against international trade as an explanation. The second comes from reasoning that even if price changes did somehow cause the increase

2. See the surveys by Freeman (1995), Richardson (1995), Wood (1995), and Feenstra (1998); and the volume by Collins (1998).

in the relative wage of skilled workers, this ought to lead firms in both tradable and nontradable industries to *economize* on these workers—shifting toward the cheaper, low-skilled workers. From figure 2, we see that exactly the opposite has occurred. According to this logic, then, international competition cannot be the main cause of the change in wages.

What is the possible response to these two strikes against international competition? From our discussion, it is clear that a response can come from several directions: (1) considering forces other than technological change that can differentially shift the demand for labor of various skills; (2) reexamining the role that product prices may have played, especially during the 1980s; and (3) questioning whether the wage trends described accurately depict the movement within specific industries and regions of the United States. These topics form the various sections of this volume, beginning with several provocative chapters that consider how and why the demand for labor of various skills has shifted.

As pointed out by Paul Krugman in the first chapter, much of the research documenting the importance of skilled-technological change has been indirect, implying that it must be present because relative wages and employment of skilled workers have moved in the same direction.[3] Krugman presents an alternative model of "quality sorting" in the labor market, in which workers' education is a signal of their skills. Higher education is required to work in a managerial position, but not all skilled workers necessarily get this education. This leads to a situation where the economy has two (stable) equilibria—a pooling equilibrium, where some skilled workers do not have higher education and do not work as managers, which has the effect of raising wages for all nonmanagerial workers; and a separating equilibrium, where all skilled workers acquire higher education and work as managers. Comparing these equilibria, the first has a more equal income distribution because the skilled workers that do not receive higher education raise the average wage for all nonmanagerial workers. In the separating equilibrium, education is acting as a signal about quality, leading to higher demand for educated workers. This means that there is greater segmentation of the workforce (high-skilled and low-skilled workers are in distinct educational and occupational groups), leading to greater wage inequality.

Krugman includes a suggestive empirical application to the economywide change in the purchasing power of factors, or in total factor productivity, within the United States. Shifts from one equilibrium to the other can lead to perverse movements in these measures, which appear to apply to the United States. In their comment, James Rauch and Magnus

3. Examples of papers taking this indirect approach are Berman, Bound, and Griliches (1994) and Berman, Bound, and Machin (1998). In contrast, Autor, Katz, and Krueger (1998) directly test for the impact of computers on labor demand.

Lofstrom investigate the earnings differentials between wage/salary workers and self-employed individuals. Since the self-employed know their own quality, education does not provide a signal (except to their customers), so the return to education should be greater for wage/salary earners than for the self-employed. This prediction is confirmed in Rauch and Lofstrom's data, and they also find that the earnings differentials between workers with high school and those with college educations has been increasing more for the wage/salary workers. These findings are supportive of Krugman's quality-sorting model.

In the second chapter, Edward Leamer and Christopher Thornberg examine another new model of wage determination. They treat the wages paid by industries as jointly determined with the effort level of individuals. Effort is not directly observable, but since it equals the product of hours per week and "intensity" of effort, they simply use hours as a proxy, which turns out to work quite well. Their theory suggests that capital-intensive industries should offer high-wage and high-effort jobs, while labor-intensive industries should offer low-wage and low-effort jobs. Graphing industry wages against effort (i.e., hours), we therefore expect to find an upward-sloping relationship, with the capital-intensive industries at the upper end of the curve. This is exactly what Leamer and Thornberg find, although there is also a backward-bending portion consisting of the most capital-intensive industries in some years, which they attribute to union pressures.

Comparing the wage-effort curve over different decades, they find that it twisted in the 1970s, offering lower pay for the low-paid jobs in the labor-intensive sectors, and higher pay for the high-paid jobs in the capital-intensive sectors. They attribute this shift to the fall in relative prices of labor-intensive goods during the 1970s due to globalization. In the 1980s they find that the entire curve shifted to the right, requiring more effort (i.e., hours) for the same weekly wage. They suggest that this shift is due to the increasing cost to firms of nonwage benefits, such as health care, or to the introduction of new equipment, such as computers. Thus, their analysis identifies a role for both international forces (during the 1970s) and technological change (during the 1980s) in changing the wage-effort jobs offered in different industries.

In the third chapter, Gordon Hanson, Deborah Swenson, and I consider the impact of international trade on the demand for labor by focusing on the offshore assembly provision (OAP) of U.S. trade law (formerly called the 806/807 provision and now called the 9802 provision of the Harmonized System). This provision allows U.S. firms to export component parts, have them assembled overseas, and then import the finished products, while only paying duty on the foreign value added. The program is used extensively by the *maquiladora* plants in Mexico, as well as in Asia, and principally in the apparel, footwear, nonelectrical and electrical ma-

chinery, and transportation equipment industries. Since the assembly that is done abroad makes the greatest use of low-skilled workers, we expect that it would have the effect of increasing the relative demand for high-skilled workers in the United States. Thus, outsourcing would have the same impact on the demand for labor in the United States as skill-biased technological change, and in this sense the two are observationally equivalent.

Gordon Hanson, Deborah Swenson, and I empirically investigate whether U.S. production under the OAP program uses more skilled (nonproduction) labor than the production done overseas, and how the magnitude of OAP trade responds to real exchange rates. The first issue amounts to a reality check for the theory. We find that the apparel and machinery industries give results closest to the theoretical expectations. The U.S. content of OAP imports shows up as relatively intensive in the use of nonproduction labor and increases in OAP imports shift demand away from production labor in the United States. For other industries, results that do not accord so well with the theory are obtained. The footwear industry generally has imprecise estimates, while in electrical machinery and transportation equipment some of the estimated coefficients are the opposite of their expected sign. In sum, the evidence from this program provides some support for the idea that outsourcing has shifted demand away from low-skilled workers in the United States, at least for the apparel and machinery industries.

The second section of the volume reexamines the role of product prices in determining wages. The chapter by Matthew Slaughter sets the stage by reviewing a number of past papers dealing with the link between industry prices and wages. This link is theoretically described by the Stolper-Samuelson theorem, and the papers that Slaughter reviews are empirical applications of this theorem. They ask whether the changes in wages across manufacturing are consistent with the changes in industry prices, or with the changes in industry productivity. Changes in prices are interpreted as international forces, whereas changes in productivity are interpreted as sector-specific technological change. Thus, this framework generally fits the "trade versus technology" paradigm. Slaughter identifies a number of weaknesses with this framework, not the least of which are that both prices and productivity are really endogenous and ought to be explained by underlying structural variables. The reader will find that this paper is a good entry into a large and growing literature.

James Harrigan also considers the role of prices, including those of nontraded goods. He treats imports into the United States as an intermediate input into a GNP function for the United States, distinguishing final outputs produced with high skills or low skills, three types of imports, three types of labor, and capital. The prices of the outputs and imports enter the GNP function, as do the supplies (or endowments) of labor and capital; the implied factor prices are obtained by differentiation of the GNP

function. The functional form chosen—translog—allows for quite general substitution between the various outputs and inputs. Of particular interest is the impact of the output and import prices on the wages of workers, distinguished by their educational level. Harrigan finds the expected Stolper-Samuelson effect, whereby a 10 percent increase in the relative prices of skill-intensive goods raises the college–high school premium by between 2.8 and 3.8 percent. This relative price of skill-intensive goods has an upward trend in his sample during the period 1980–95, which can therefore partially explain the increase in the college–high school premium. Surprisingly, however, the upward trend in this price is driven primarily by an increase in the price of nontraded services, such as finance, insurance, real estate, and various other miscellaneous services. The direct impact of import prices on wages is negligible in his estimates.

Robert Lawrence questions whether the convention of viewing product prices as being determined by international forces, and productivity as being determined by domestic technological change, is really valid. For example, Wood (1995, 67) has suggested that imports from developing countries lead firms in the industrial countries to develop unskilled-labor-saving technologies, thereby linking trade and technological change. Lawrence examines the extent to which changes in productivity in U.S. industries are correlated with measures of trade, using either import and export prices, or quantities.[4] Both of these measures should be treated as endogenous, so he performs both ordinary least squares and two-stage least squares estimation. The results show a modest impact of import competition on productivity, although the statistical significance depends on the estimation method. Lawrence also considers the impact of these variables on the employment share of workers with just high school education. Industries with higher initial imports (especially from developing countries) show greater declines in the high school–educated share of employment, although again the statistical significance is weak.

The third section of the volume presents remarkable new evidence on regional variation in wages and employment, a theme that has begun to be studied in recent research.[5] Andrew Bernard and Bradford Jensen analyze how the wage premium (the part of wages that is not explained by worker characteristics) varies across states over time, using data on individuals at 10-year intervals. They find that state wages are much more responsive to regional employment shocks (in any industry) than to na-

4. Wood and Lawrence both recognize that a firm theoretical basis for the link between trade and productivity is lacking. The interested reader can consult work by Horn, Lang, and Lundgren (1995), which establishes a link of this type using a model where managerial effort is not directly observed by the owner of a firm.

5. For example, Lee (1999) uses regional variation in the effective minimum wage to argue that reductions in the real minimum wage during the 1980s account for much of the rise in dispersion in the lower tail of the wage distribution.

tional shocks in the same industry. In other words, labor markets are not well integrated across states in the short or medium run, so that state variation in wages can be expected to persist. Inequality of wages at the state level is measured by the difference in the 90th and 10th percentile wage premia. Bernard and Jensen find a surprising pattern of changes in inequality during the 1970s and 1980s, whereby states located around the Great Lakes have experienced rising inequality (like the national trend), but states in the Southeast have experienced falling wage inequality. Many of these state-level changes are larger than the national changes that have occurred, suggesting that the focus on national changes taken by most researchers may be missing an important part of the story.

Bernard and Jensen also correlate these wage changes with other state variables such as real exchange rates, inflows of immigrants, labor market characteristics, and so forth. After controlling for state- and time-fixed effects, the only variable that is consistently important in explaining the cross-state change in wage inequality is the share of employment in durable manufacturing. Declines in this variable are strongly associated with increases in inequality. Left open for further research, then, is the question of what factors led to the decline in durable manufacturing employment.

Some progress on this question is made by Linda Goldberg and Joseph Tracy, who analyze the effect of industry-specific real exchange rates on industry wages and employment at the state level. Like Bernard and Jensen, they find that effects at the state level are often more pronounced than at the national level, but, in contrast to them, Goldberg and Tracy find that changes in real exchange rates have an impact on wages. Dollar appreciations (depreciations) are associated with employment declines (increases) for high- and low-profit-margin industry groups. When industries are more export oriented, the adverse consequences of appreciations for employment increase, although these adverse consequences are offset when industries increase their reliance on imported inputs. Their analysis confirms the type of dynamic patterns of adjustment in local labor markets previously reported by labor economists, whereby wages increase in response to current relative demand shocks, and decrease in response to expected future relative demand shocks (presumably because the supply of labor rises).

Mary Lovely and David Richardson investigate the wage differentials offered across industries, while correcting for differences in the skill level (education) of workers. The theory that they draw on allows for trade in horizontally differentiated producer goods between northern countries, and vertically differentiated producer goods (or outsourcing) between northern and southern countries. They point out that there is no unique relationship between increases in outsourcing and inequality of wages (across different skill groups) in this model: It all depends on which exogenous change leads to the increased outsourcing. An increase in the south-

ern human capital endowment is associated with greater inequality of wages in the northern countries, but an increase in the northern human capital endowment is associated with reduced inequality, even though both of these lead to increased outsourcing.

In their empirical work, Lovely and Richardson therefore distinguish whether changes in trade flows for the United States come from industrialized countries, newly industrialized countries, or primary-product exporters. Using data on individuals, they first estimate the industry wage premiums for workers of various education levels. An intriguing finding is that the industry differentials are usually highest for the least-educated workers, vanishing for those with college degrees. They suggest that the industry differentials may therefore reflect local labor markets for less-skilled workers. Lovely and Richardson correlate the industry wage premiums to various measures of international trade and other control variables. Some evidence that trade affects the wage differentials is found, particularly when the type of trade partner is distinguished. Trade with newly industrialized countries has the greatest effect on industry wages: Imports reduce wages and exports increase wages. Also, distinguishing workers by their level of education suggests that these impacts of trade apply most strongly to skilled workers, while the effects on less-skilled workers are sometimes insignificant or of surprising sign. In sum, the impact of international trade on industry wage differentials is quite nuanced when types of workers and trading partners are distinguished, as suggested by the theory.

In the final chapter, Lori Kletzer investigates the impact of trade and outsourcing on labor displacement with U.S. manufacturing industries. Workers laid off from an industry (but not those who quit or are fired) are called displaced, and the annual number of these relative to total industry employment is the displacement rate. This is a measure of the gross employment change in an industry and is much larger than the net change (layoffs minus new hires). Kletzer investigates whether job displacement across U.S. manufacturing industries can be explained by imports, exports, and other variables. She finds a modest role for imports in leading to greater displacement, whether it is measured as imported intermediates (outsourcing) or not, but this effect is not always statistically significant. Increases in exports have a stronger effect on reducing job displacement.

Kletzer also investigates the pattern of wage losses faced by workers displaced from various industries and rehired in others. Among the largest wage reduction is that for workers displaced from durable manufacturing and rehired in nontraded services. Some of the industries in durable manufacturing are also import competing, and so this result suggests that import competition leads to earning losses. However, other import-competing industries (such as office and accounting machines, computers, and photographic equipment) experience less job displacement, and below-average earnings losses. So the connections among import competi-

tion, job displacement, and earnings losses are complex. Nevertheless, a sizable number of workers displaced from import-competing industries experience above-average earnings losses that can be attributed at least in part to the pressures of international competition.

In sum, the papers in this volume find some role for international trade in affecting the wages earned by American workers—notably through outsourcing, as considered by Hanson, Swenson, and me, and by Lovely and Richardson—although there are certainly other powerful forces at work. It is notable that Harrigan finds so little influence from import prices in his estimation of a GNP function for the United States, and such a strong influence from nontraded goods prices. Two especially intriguing empirical findings are the shifting of the wage-effort curve analyzed by Leamer and Thornberg, and the remarkable variation in wage inequality across U.S. states measured by Bernard and Jensen. In both cases, it is possible that international competition has been among the underlying causes of these phenomena, but not in a manner that allows it to be easily separated from other causes. The results of Kletzer support those of Bernard and Jensen in that it is the decline of durable goods industries, with the resulting displacement of workers, that is associated with the largest wage losses and resulting inequality. We do not know what has caused the decline in durable goods manufacturing in the states around the Great Lakes, but international competition remains a likely candidate and worthy of further exploration.

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