Federal Reserve Bank of New York

Economic

Policy Review

Note to REVIEW *Readers:*

With my arrival as Director of Research at the Federal Reserve Bank of New York, the Research and Market Analysis Group is seeking to become more externally oriented. To this end, we are making substantial changes to our publications.

In this issue, we introduce a new title for our recently redesigned QUARTERLY REVIEW*: the* ECONOMIC POLICY REVIEW*. As the revised title suggests, our new* REVIEW *will have a very explicit policy orientation.*

Together with this change in title, we also introduce in this issue a distinguished group of academic economists who will serve on our new editorial board. At least one member of our editorial board will have commented on each of the articles we have decided to publish.

As complements to our new REVIEW*, we expect to initiate several additional publications within the coming months. The first of these will be a series of working papers under the title* STAFF REPORTS*. These are designed to stimulate discussion and critical comment. Abstracts of the* REPORTS *will be listed in future issues of the* ECONOMIC POLICY REVIEW*.* STAFF REPORTS *will typically be more technical than articles appearing in the* REVIEW*.*

A second publication we plan to introduce, CURRENT ISSUES IN ECONOMICS AND FINANCE*, will offer timely, brief articles of interest to the general public.* CURRENT ISSUES *will be published at least once a month and more frequently over time.*

Lastly, we plan to introduce a quarterly newsletter of Second District regional economic and financial conditions. This newsletter will be produced jointly by the Research and Public Information departments.

All of these initiatives underscore the broad range of people we hope to reach through our new publications. These initiatives also reflect a commitment on our part to communicate as extensively as we can with the public on a host of issues of intellectual and policy importance.

We hope that these new publications will interest you.

Frederic S. Mishkin
Executive Vice President and
Director of Research

INTRODUCTION TO THIS ISSUE

On November 4, 1994, the Federal Reserve Bank of New York held a colloquium on U.S. wage trends during the 1980s and early 1990s. Prominent academic economists joined executives, journalists, and Federal Reserve Bank economists to examine the growing inequality between the wage rates of low-skilled and high-skilled workers.

This issue of the ECONOMIC POLICY REVIEW is dedicated to the proceedings of the colloquium. It contains eight papers presented by the academic participants, a background paper by Bank economists, and summaries of the day's discussion. The authors explore the causes of the recent wage trends, the likely future direction of these trends, and the alternatives open to policymakers to improve the economic position of low-skilled workers.

The papers focusing on the causes of wage inequality point to such factors as the increasing numbers of low-skilled immigrants, the growing competitive pressure on low-skilled industries from developing country imports, and the technological advances that have favored better educated employees. The papers discussing the future and what can be done about the growing wage gap consider the impact of improving training programs, providing wage subsidies, or undertaking other government initiatives. These latter papers also contemplate the potential cost to society of not responding to recent wage developments.

The consensus arising from the day's discussion was that wage disparity poses a very serious problem for the United States, jeopardizing the welfare of less skilled individuals and of society as a whole. While acknowledging that there are no easy solutions, the participants underscored the need to find viable methods of upgrading the productivity and earnings of low-skilled workers.

Federal Reserve Bank of New York Economic Policy Review

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BACKGROUND

Opening Remarks

William J. McDonough
President, Federal Reserve Bank of New York

I am very pleased that all of you are here today to discuss what I feel is a critical issue facing our country. The issue is, of course, the growing disparity in wages earned by different segments of our labor force. It is deeply troubling that during the 1980s, the real wages of low-skilled workers in the United States have fallen sharply, both in absolute terms and relative to the wages of high-skilled workers.

Unfortunately, we can no longer argue these disturbing developments away. By any measure—whether blue-collar worker versus white-collar worker, high school dropout versus college graduate, production worker versus supervisory worker—low-skilled employees have clearly fallen behind high-skilled employees during a decade when the United States experienced substantial overall growth. We also cannot console ourselves with the argument that increased benefits compensated the low-skilled workers for their relative wage decline. Even including benefits, the compensation earned by low-skilled workers fell by roughly 10 percent relative to high-skilled workers—and stagnated in real terms—during the 1980s.

There is no doubt: our working poor have suffered a material blow. We are now in the position where the head of a family of four, working forty hours a week and earning the average wage in retail sales for someone without a high school degree, finds that his or her family's income just equals the poverty line. A decade ago, his or her family's income significantly exceeded this level.

These dramatic wage developments raise profound issues for the United States—issues of equity and social cohesion, issues that affect the very temperament of the country. We are forced to face the question whether we will be able to go forward together as a unified society with a confident outlook or as a society of diverse economic groups suspicious of both the future and each other.

For us at the Federal Reserve, wage inequality itself is, of course, not directly a part of our mandate. Our foremost task is to maintain price stability. Nevertheless, we must be cognizant of the growing wage disparity and its impact on various segments of our labor force. Our task of maintaining a stable economy will be that much easier to accomplish if we can carry it out in a society that has formed a consensus as to the benefits likely to come from stable growth.

Let me conclude on a positive note. Today, we have assembled a distinguished group of experts who offer the best hope we have of attacking our wage problem head on. From very early analysts of the growing wage gap, such as

Barry Bluestone and Bob Lawrence, to insightful newcomers to the wage disparity debate, such as Olivier Blanchard and Richard Clarida, we could not ask for a better or more comprehensive panel of academics to discuss the issues before us. Moreover, we have very perceptive observers—the practioners Ronald Blackwell, Margaret Hayes, Mitchell Fromstein, and Herb Washington, and the columnists Peter Passell and Samuel Brittan—to help keep us grounded in reality. Consequently, we at the New York Fed are very excited about today's program. Let us now begin.

The Internationalization of the U.S. Labor Market and the Wage Structure

George J. Borjas*

Beginning with the important work of Murphy and Welch (1992), a great deal of recent research has attempted to document and explain the dramatic changes in the wage distribution that occurred during the 1980s (see also Katz and Murphy 1992). Practically every income group faced a decline in real wages during the 1980s. However, workers at the 33rd percentile experienced a 14 percent drop in the real wage, workers at the 66th percentile experienced only a 6 percent drop, and workers in the upper tail of the distribution experienced a 1 percent wage increase. Therefore, the widening of the wage distribution occurred because the relative wage of less skilled workers fell dramatically during the decade.

Although these facts are indisputable, there is considerable disagreement about the causes of the increase in wage inequality. The trends can be understood in terms of a simple supply-demand equilibrium story. It is well known that the labor market entry of the large baby boom cohort in the 1970s shifted out the supply curve of college graduates, thus depressing the payoff to a college education throughout much of that decade. During the 1980s, however, the rate of increase in the supply of college graduates slowed dramatically. The relative decline in the number of new labor market entrants with a college education raised the wage gap between college graduates and less educated workers. It turns out, however, that if the elasticity of labor demand has a reasonable value, the supply shifts cannot generate the huge increase in the returns to schooling that occurred during the 1980s. As a result, it must also be the case that the demand for skilled workers shifted out by more than the demand for unskilled workers.

A number of hypotheses can explain the differential shifts in labor demand. For instance, the de-unionization of the labor market probably had a particularly adverse impact on the wage of unskilled workers. Because unions

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"prop up" the wage of less skilled workers, the drop in the demand for union labor would raise the wage gap between skilled and unskilled workers. Some studies conclude that perhaps as much as half of the increase in wage inequality can be attributable to the decline in unions (Freeman 1993).

The relative demand for skilled workers may also have increased because of skill-biased technical change. Some studies, in fact, argue that this type of technical change explains most of the increase in wage inequality in the United States (Bound and Johnson 1992; Berman, Bound, and Griliches 1994). If the technological advances that are being introduced constantly into the labor market are good substitutes for unskilled workers and complement the skills of highly educated workers, technical change would lower the demand for unskilled labor and increase the demand for skilled labor.

The internationalization of the U.S. labor market, either through trade or immigration, probably contributed significantly to the rise in wage inequality (Murphy and Welch 1991; Borjas, Freeman, and Katz 1992; Borjas and Ramey 1994). In 1979, trade between the United States and the rest of the world was balanced: exports exceeded imports by only about 1 percent. By the mid-1980s, the trade deficit in durable goods was equal to 2.5 percent of GDP. If the imported goods compete with goods produced by relatively unskilled workers, the demand for unskilled workers would be affected by the trade deficit. The increasing internationalization of the U.S. economy also occurred because of a sizable increase in immigration. In 1980, only 13 percent of workers with less than a high school education were foreign-born; by 1990, nearly a quarter of the high school dropouts were immigrants. This paper summarizes some of the evidence linking the internationalization of the U.S. labor market with the changes in the wage structure.

IMMIGRATION

There are two distinct ways in which immigration can alter the U.S. wage structure. Even if immigrants do not affect the wage of native workers, immigrants will change the shape of the wage distribution as long as the skill distribu-

tion of immigrants differs from the skill distribution of native workers. In fact, there have been major changes in the skill distribution of the immigrant flow during the past thirty years. In particular, more recent immigrant waves are relatively less skilled than earlier waves (Borjas 1985, 1995).

Chart 1 illustrates these changes by using decennial Census data to calculate the fraction of immigrant workers found in each of twenty quantiles of the native wage distribution between 1970 and 1990. If immigrants had the same skill distribution as natives, 5 percent of the immigrant work force would be found in each quantile. As the figure shows, however, more recent immigrants tend to be disproportionately unskilled. In 1970, for example, only 5.6 percent of immigrant workers were in the first quantile of the wage distribution (that is, in the bottom 5 percent of the distribution), and 6.1 percent were in the twentieth quantile (that is, in the upper 5 percent of the wage distribution). By 1990, however, more than 9 percent of immi-

Chart 1

IMMIGRANT PLACEMENT IN NATIVE WAGE DISTRIBUTION 1970-90
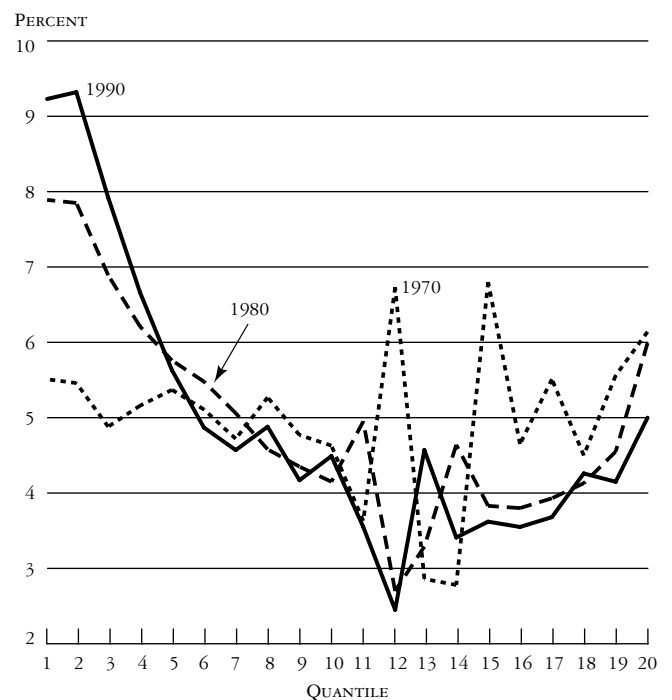
Source: Author's tabulations from public use sample of the decennial Censuses. Values are calculated for the sample of men aged 25 to 64, who work in the civilian sector, are not self-employed, and do not reside in group quarters.

grants were in the first quantile and exactly 5 percent were in the twentieth quantile.

Because the volume of immigration has increased rapidly in the past two decades *and* because the skills of immigrants differ significantly from those of natives, immigrants distort the shape of the aggregate wage distribution. In particular, the disproportionate increase in the number of less skilled immigrants may have increased aggregate wage inequality. Immigrants also have an additional impact on the wage structure because the supply shifts caused by immigration will likely affect the earnings of similarly skilled natives.

Many studies attempt to estimate the impact of immigrants on native wages by regressing the native wage in a particular labor market or locality on the relative quantity of immigrants in that locality (or the change in the wage in the locality over a specified time period on the change in the number of immigrants in the locality). These across-city correlations generally indicate that the average native wage is slightly lower in labor markets where immigrants tend to reside (see Altonji and Card 1991 and LaLonde and Topel 1991). The point estimates of the elasticity of the native wage with respect to the number of immigrants cluster around -.01 to -.02, so that if one city has 10 percent more immigrants than another, the native wage in the city with more immigrants is only about .2 percent lower.

Studies of specific labor markets confirm the finding that immigration seems to have little impact even when the market receives very large immigrant flows. On April 20, 1980, Fidel Castro declared that Cuban nationals wishing to move to the United States could leave freely from the port of Mariel. By September 1980, about 125,000 Cubans, mostly unskilled workers, had chosen to undertake the journey. Almost overnight, Miami's labor force had unexpectedly grown by 7 percent. Card's (1990) influential analysis of the data indicates that the time-series trend in wages and employment opportunities for Miami's workers, including its black population, was barely nudged by the Mariel flow. The trend in the wage and unemployment rates of Miami's workers between 1980 and 1985 was similar to that experienced by workers in such cities as Los Angeles, Houston, and Atlanta, cities that did not experience the Mariel flow.

It is important to stress that the correlations estimated in this extensive literature do not truly answer the question whether native workers are adversely affected by immigration. In particular, the comparison of economic conditions in different metropolitan areas, as well as the pre- and post-immigration comparison in a particular metropolitan area, presumes that the labor markets are closed (once immigration takes place) and that the migration flow is exogenous.

Metropolitan areas in the United States are not closed economies: labor, capital, and goods flow freely across localities and tend to equalize factor prices in the process. In other words, native workers and firms vote with their feet and respond to the entry of immigrants by moving to areas offering better opportunities. This migration attenuates the cross-section correlation between the wages of natives and the presence of immigrants. As a result, the comparison of local labor markets may be masking the "macro" effect of immigration. Moreover, immigrants do not simply land in a randomly chosen metropolitan area; presumably they choose areas that provide the best opportunities. Therefore, the correlations typically estimated in the literature have no structural interpretation; they do not estimate the demand function for native workers, nor do they estimate the reduced-form impact of immigrants on native employment opportunities.

A recent study of time-series data drawn from the Current Population Survey provides indirect evidence of the macro impact of immigration. Borjas, Freeman, and Katz (1992) conclude that the large increase in the relative number of unskilled workers caused by immigration explains about a third of the 10 percentage point decline in the relative wage of high school dropouts between 1980 and 1988. Similarly, Topel (1994) finds that the relative decline in the wage of less skilled workers during the 1980s was steepest in labor markets that had a sizable immigrant presence.

To reconcile the finding that local labor markets do not seem to be affected by immigration with the possible existence of an economy-wide impact, Filer (1992) ana-

lyzes how the internal migration flows of U.S.-born workers respond to immigration. Using 1980 Census data, he finds that metropolitan areas where immigrants cluster experience lower rates of native in-migration and somewhat higher rates of native out-migration. This pattern of native mobility, of course, dissipates the impact of immigration over the entire economy. The evidence for more recent time periods, however, seems to be mixed. Using various Current Population Survey supplements from the 1980s, Butcher and Card (1991) estimate a positive correlation between immigration flows and the in-migration rates of natives to particular cities, while Frey's (1994) study of the 1990 Census reveals that less skilled native workers residing in states that received large immigrant flows in the late 1980s had relatively high probabilities of out-migration.

TRADE

Chart 2 illustrates the relationship between the rise in wage inequality in the United States and the increasing volume of foreign trade. The chart shows the similar trends exhibited by (1) the age-adjusted log wage differential between highly educated and less educated workers and (2) net imports in durable goods as a percentage of GDP. As indicated by the early work of Murphy and Welch (1991), higher trade deficits in durable goods are associated with a larger wage gap between skilled and unskilled workers throughout much of the 1949-90 period.

A series of statistical tests presented in Borjas and Ramey (1994) examine the robustness and interpretation of the time-series correlation between wage inequality and a number of variables that have been proposed as "causes" of the increase in wage inequality, including changes in labor supply, the de-unionization of the U.S. labor force, an increase in research and development expenditures, changes in the female participation rate, and net imports in durable and nondurable goods. The Borjas-Ramey analysis indicates that the *only* variable that is cointegrated with the trend in wage inequality is net imports in durable goods as a percent of GDP. In other words, only the durable goods deficit has the same stochastic long-run trend as the time series on wage inequality between 1963 and 1988.

Why does trade in durable goods matter so much for wage inequality? Durable goods in the United States are typically produced by industries that not only employ a relatively large number of unskilled workers, but that are also highly concentrated and unionized, and pay relatively high wages. In 1976, for example, 78 percent of all workers employed in a set of trade-impacted highly concentrated industries (such as automobiles and steel) were high school graduates or dropouts. Moreover, workers in the automobile industry earn about 24 percent more than equally skilled workers employed in other industries, while the wage advantage for workers employed in the steel industry is about 16 percent. In other words, workers in these trade-impacted industries (who are predominantly less educated) get some of the rents in the industries through higher wages.

When foreign firms enter markets in which domestic firms have substantial market power, they cap-

Chart 2

DURABLE GOODS TRADE DEFICIT AND THE RETURN TO SKILLS 1949-90
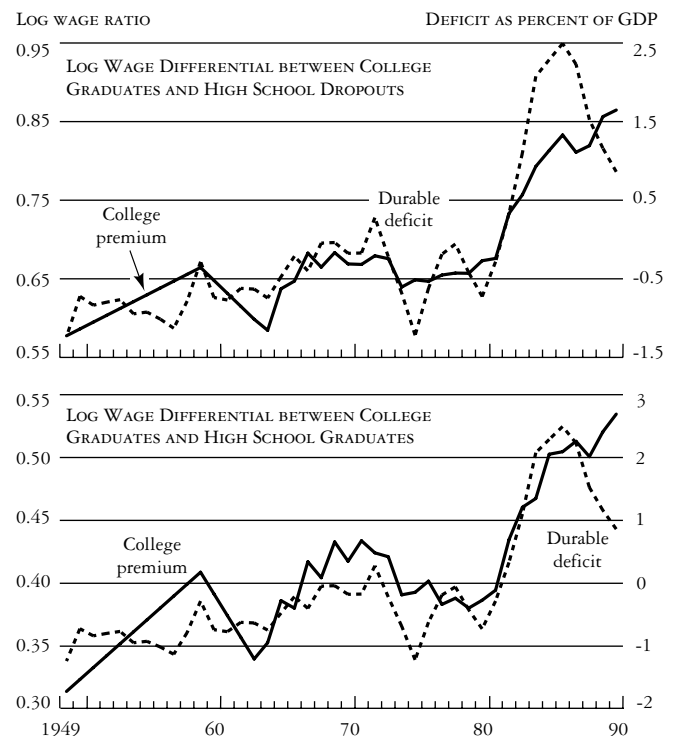
Source: Borjas and Ramey 1994.

ture rents that would otherwise go to the domestic industry. This entry decreases the relative wage of unskilled workers in two distinct ways. First, because the rents of domestic firms have fallen, the wage of workers still employed in these industries declines. Second, to the extent that foreign competition reduces employment in the concentrated industries, many of the workers must move to the lower paying competitive sectors of the economy. Overall, the wage of less educated workers falls relative to that of college-educated workers.

The empirical work in Borjas and Ramey (1993) suggests that the trade deficit in durable goods can have a numerically important impact on aggregate wage inequality. Using simple accounting methods, the authors calculate the extent to which employment changes in trade-impacted highly concentrated industries affect aggregate wage inequality. The increasing volume of foreign trade (between 1976 and 1990) accounts for about 50 percent of the decline in employment in these industries, as well as 25 percent of the change in aggregate wage inequality.

This approach also provides an explanation of the regional differences that exist in the evolution of the wage structure. As Karoly and Klerman (1993) and Topel (1994) have shown, wage inequality has not increased evenly across regions. Borjas and Ramey report a significant negative correlation between employment changes observed in trade-impacted concentrated industries in a particular locality (defined as a metropolitan area) and the trend in wage inequality in that locality. In other words, employment declines in these industries raise the wage gap between highly educated and less educated workers.

It is important to point out, however, that the trade story does not provide a complete explanation of the changes in wage inequality during the entire period. There is an important timing problem in the empirical evidence. As shown in Chart 2, the trade deficit in durable goods began to decline after 1988, but wage inequality continued to rise. The underlying reason for the breakdown of the long-run relationship between wage inequality and trade is that even though the trade situation in durable goods began to improve in the late 1980s, employment in these trade-impacted industries continued to decline, driving down the relative wage of unskilled workers even further.

SUMMARY

The empirical evidence suggests that the increasing internationalization of the U.S. labor market, through both immigration and trade, has had an important impact on the wage structure. Immigration has probably increased aggregate wage inequality because more recent immigrant waves tend to be less skilled than earlier waves. Moreover, it is likely that the large number of unskilled immigrants who entered the United States in the past two decades have had an adverse effect on the employment opportunities of less skilled native workers. Trade in durable goods has increased wage inequality because durable goods industries employ a disproportionately large number of less skilled workers and these workers receive relatively higher wages than workers in more competitive sectors of the economy. The trade deficit in durable goods has reduced the rents going to domestic firms (and workers) and has had adverse spillover effects as displaced workers move from the trade-impacted industries into other sectors of the economy. It will be of great interest to see how the current trends in immigration and trade will affect the evolution of the wage structure in the 1990s.

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What Are the Causes of Rising Wage Inequality in the United States?

John Bound and George Johnson*

During the past fifteen years—but especially during the 1980s—most measures of wage and earnings inequality in the United States increased. The facts are as follows:

- The relative earnings of more educated relative to less educated workers (of both genders), after falling somewhat in the 1970s, rose precipitously in the 1980s. The college/noncollege relative wage has continued to rise during the early 1990s, but at a slower rate than in the 1980s.

- For workers who are not college-educated, the ratio of older to younger workers' wages increased substantially during the 1980s. This trend has continued into the early 1990s for women and at a slower rate for men.

- The ratio of women's to men's wages, other observable variables held constant, increased slightly during the 1970s, rapidly during the 1980s, and even more rapidly in the early 1990s. Since women tend to earn less than men, this development, unlike the others, reduced wage and earnings inequality.

- For most subgroups of the work force, the variance of earnings after adjusting for the effects of observable variables (education, age, region, union representation, and so forth) increased in the 1970s and 1980s. Our preliminary analysis of 1993 Current Population Survey data suggests that within-group variation has not changed perceptibly in the early 1990s.

These developments with respect to the structure of earnings have occurred during a twenty-year period in which, depending on which price index is utilized, the average level of real wages has been either constant or falling slightly. Thus, gains for one group of workers (college graduates, women, persons in their forties and fifties, and those in the highest percentiles of their relevant wage distributions) may appear to the public to come at the expense of other groups (that is, the outcome of some sort of zero per capita sum game). The situation has spurred all sorts of policy proposals, ranging from import restrictions to a major increase in government training programs.

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A rational policy response to the observed changes in the real level and structure of earnings must, of course, be based on a diagnosis of the causes of the changes, and "the causes of rising inequality" question has spurred a great deal of research by economists. The major candidates for explaining the wage structure phenomena in this (relatively new and rapidly growing) literature include the following:

A. Changes in the composition of labor supply—including a slowdown in the growth rate of that fraction of the work force with high levels of schooling, the effects of the increase in the labor force attachment of women, and an increase in the supply of low-skilled immigrants (both legal and otherwise).

B. The increased openness of the U.S. economy, magnified by the trade deficit that emerged in the 1980s (and that will continue as long as the national saving rate remains low).

C. The decline in the relative importance of trade unionism in the United States.

D. An acceleration in the rate of skill-biased technological change, brought about in large part by the adoption of computer technology.

This paper is an interim report on continuing work that we began in 1988. Our earlier research on the causes of wage structure changes in the 1980s (Bound and Johnson 1992) showed that part of explanation A (the slowdown in the growth rate of that fraction of the work force with high levels of schooling) and especially explanation D were the most plausible; explanations B and C, within our methodological framework, did not appear to be very important. However, an explanation (of anything) that involves technological change is necessarily circumstantial (as opposed to the "smoking gun" type of evidence), and there is clearly a distribution of opinion in the emerging literature on the question of the relative explanatory power of A, B, C, and D.

The ultimate determination of the "correct" explanation of the wage structure phenomena of the 1980s will depend in large part on what happens to them in the future. Accordingly, in the next section, we compare changes in wages from 1988 to 1993 with the changes of the 1970s and 1980s, which have been the primary focus of

the literature. In the following section, we return to what we think has been learned about the causes of changes in the wage structure.

WAGE CHANGES FROM THE 1970S TO THE 1990S

Many of the facts about changes in the structure of wage rates listed above are apparent from inspection of Table 1, in which estimated (geometric) mean wage rates of high school and college graduates for four different amounts of potential labor market experience (age 18 for high school and age 22 for college) are reported separately for men and women. The wage rates are in 1993 prices (adjusted by the deflator for personal consumption expenditure).

The behavior of these data between 1973 and 1988 has been the subject of numerous papers (see Kosters 1991 and the survey paper by Levy and Murnane 1992). Two of the trends of the 1980s, the increases in the relative earnings of highly educated workers and of women, appear to have continued in the 1988-93 period, the first at a slower rate and the second at a faster rate. First, the annual growth rate of the college/high school relative wage during the 1979-88 interval was 1.8 percent for men and 1.3 percent for women. For the 1988-93 interval these rates of divergence were, respectively, 0.7 and 0.9 percent. It thus appears that the growth of the educational differential is continuing, but the growth is declining.[1] Second, during the 1980s the relative wage of women, other things equal, grew by 0.8 percent per year, and in the 1988-93 interval this rate of convergence increased to 1.3 percent.

An alternative comparison of the 1979-88 and 1988-93 intervals is given in Table 2. The table relates logarithmic changes in median weekly earnings data by occupation and by gender to three variables: the proportion of workers in that occupation of that gender with 4+ years of college (from the 1980 Census), whether or not the occupation is "white collar" (professional, managerial, technical, or clerical), and a dummy variable for a female observation. The per annum effect of the first and second variables was positive in both periods but greater in the first than in the second interval. The estimated *ceteris paribus* relative wage increase of women was slightly greater than the estimates

based on the micro data in the 1980s and slightly smaller in the 1988-93 period.[2]

REASONS FOR THE RISE IN INEQUALITY

One of the major puzzles about the behavior of the wage structure during the 1980s is why the return to observed skill (education and experience) rose while the labor force was becoming more educated and older. In terms of a conventional market-clearing model of the labor market, the observation of a rise in the relative price of skill in the face of an increase in its relative supply means that the relative demand function must have shifted to the right during the 1980s (see figure on page 12). This conclusion is the starting point for most analyses of the problem.

RELATIVE SUPPLY CHANGES

There are many (roughly an infinity) of alternative approaches to the disaggregation of the aggregate labor force into skill categories. The most straightforward of these, following Katz and Murphy (1992), is to transform different groups into units of high school labor and units of college labor. The relative supply of higher to lower skilled labor is then $s = (N_{co}+\mu_{co}N_{co})/(N_{hs}+\lambda_{do}N_{do}+\lambda_{so}N_{so})$, where N_i is the aggregate employment of labor in each of the four educational categories and μ_{so} and the λ_i's are the contribution of each category to the relevant flow of labor services. Estimates of the fraction of total employment (in all experience groups and both genders) for 1960-93 are shown in Table 3 as well as a version of s with $\lambda_{do}=.8\,\lambda_{so}=\mu_{so}=.50$.[3]

Table 1
ESTIMATED AVERAGE REAL WAGE RATES OF HIGH SCHOOL AND COLLEGE GRADUATES
By Years of Potential Experience (x) and Gender

	Hourly Wages (1993 Dollars)				Growth Rates		
	1973	1979	1988	1993	1973-79	1979-88	1988-93
MEN							
x=5							
High school	11.03	10.43	8.92	7.73	-.009	-.017	-.029
College	14.30	13.25	14.84	13.18	-.013	.013	-.024
x=15							
High school	14.38	14.07	12.58	11.17	-.004	-.012	-.024
College	19.09	17.79	18.07	16.96	-.012	.002	-.013
x=25							
High school	15.64	14.91	14.52	12.62	-.008	-.003	-.028
College	21.01	19.90	20.85	18.75	-.009	-.005	-.021
x=35							
High school	15.41	15.15	14.71	13.37	-.003	-.003	-.019
College	20.62	19.65	21.53	19.77	-.008	.010	-.017
WOMEN							
x=5							
High school	8.06	8.00	7.55	6.98	-.001	-.006	-.016
College	11.76	10.81	12.21	11.83	-.014	.014	-.006
x=15							
High school	10.50	9.01	9.28	8.98	-.026	.003	-.006
College	12.74	12.38	13.89	14.37	-.005	.013	.007
x=25							
High school	9.28	9.26	9.44	9.27	.000	.002	-.004
College	13.59	12.27	13.73	14.38	-.017	.013	.009
x=35							
High school	9.48	9.39	9.43	9.15	-.002	.000	-.006
College	14.11	12.24	13.61	14.17	-.024	.012	.008

Sources: Bound and Johnson 1992 for 1973-88, updated with data from the Current Population Survey for 1988 and 1993. Price index used is the personal consumption deflator, *Economic Report of the President*, 1994, Table 3.

The relative supply of skills increased at a slower rate in the 1980s than in the 1970s, in part because of the huge temporary increase in male college enrollment in the late 1960s. Given the rate of shift of the relative demand function, the average rate of growth (for men and women) of the college/high school relative wage during the 1979-88 interval, .016, would have been much lower. Using the values of s in Table 4, we determine that the amount by which it would have been lower is the reciprocal of the relative labor demand elasticity (about 1/1.5) *.042-.029 = .0087.[4]

Two other forms of labor supply change have been occurring since the early 1970s. First, the large increase in the average degree of labor market attachment of women has caused an increase in the ratio of their average actual to potential labor market experience. In addition, women are tending to enter many jobs that were once performed almost entirely by men.[5] Thus, women's wage/potential experience profiles are gradually looking more like men's, and the rate of convergence increased in the 1988-93 period. Second, the growth rate of the effective supplies of relatively low-skilled labor has been much larger because of the large-scale immigration (both legal and illegal) of the 1980s, which presumably has continued into the 1990s. Aggregating immigrants' labor services with those of natives poses additional technical problems, but immigration appears to have had a nonnegligible effect on rising inequality in the United States.[6]

THE INCREASE IN NET IMPORTS

Considerable attention has been paid to international economic integration and the emergence of a quasi-permanent foreign trade deficit for the United States. These developments have led several observers to identify net imports as a cause of rising wage inequality. The most trade-sensitive sectors of the economy tend to be very low-skill-intensive (as Table 4 shows for durable goods and mining). These industries also tend to pay higher wage rates than other industries. Thus, a decrease in the relative size of these

Determination of Relative Wages by Skill with Shifting Relative Demand and Supply Curves

	1979-88			1988-93		
	(1)	(2)	(3)	(4)	(5)	(6)
Proportion college	.304 (.039)	-	.314 (.058)	.101 (.018)		.084 (.028)
White collar	-	.099 (.021)	-.006 (.026)	-	.036 (.009)	.005 (.013)
Women	.119 (.021)	.118 (.026)	.119 (.021)	.042 (.010)	.042 (.011)	.042 (.010)
Intercept	.256 (.012)	.269 (.016)	.257 (.013)	.123 (.006)	.126 (.007)	.122 (.006)

Sources: U.S. Census, Occupation Characteristics, 1980; *Employment and Earnings*, January 1989, Table 54, and January 1994, Table 54.
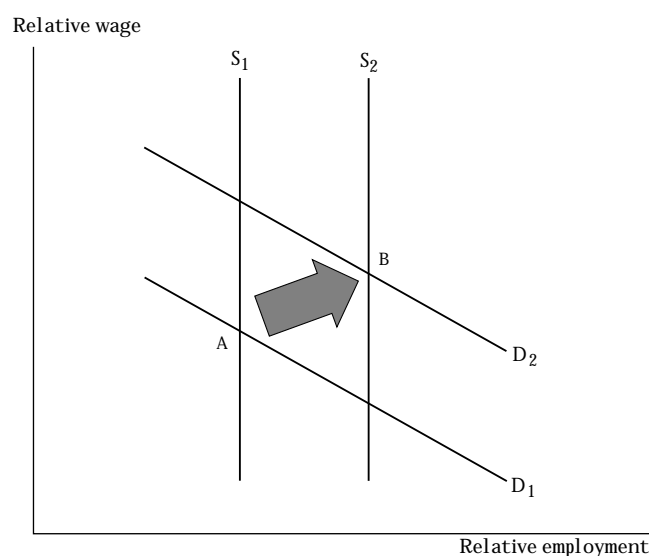
Table 3
DISTRIBUTION OF EMPLOYMENT, AGES 18-24
By Years of Schooling

	1960	1973	1979	1988	1993
Dropouts (<12)	.504	.267	.191	.125	.143
High school (12)	.286	.426	.431	.422	.346
Some college (13-15)	.111	.179	.186	.213	.288
College (16+)	.099	.158	.193	.239	.253
Relative skill index (s)	.196	.308	.398	.515	.604

	Growth Rates			
	60-73	73-79	79-88	88-92
Relative skill index	.035	.042	.029	.032
College/noncollege	.042	.040	.030	.015

Sources: Data for 1960: 1960 U.S. Census, Employment Status and Work Experience, PC (2)-6A, Table 20; data for 1973-88: Bound and Johnson 1992, Table 1; data for 1993: *Current Population Reports*, P20-476.

industries would have the effect of increasing the relative wages of skilled worker through both a market effect and a reduction in the relative average rents received by less skilled workers.

The strongest case for international developments as the cause of rising inequality is advanced by Borjas and Ramey (1994). They relate the college/high school relative wage to a number of potential causal factors and conclude that the increase in the durable goods trade deficit/GDP,[7] which rose about 2 percentage points from 1979 to 1987, is the only variable that consistently tracks the path of W_{co}/W_{hs}. Their results suggest that if the United States eliminated the current trade deficit (through appropriate policies to bring aggregate spending in line with aggregate supply), W_{co}/W_{hs} would return fairly quickly to its 1979 value.

The problem with this argument is that the durable goods sector constitutes too small a fraction of the employment of all educational groups to have been able to generate relative wage movements of the magnitude observed during the 1980s. A more plausible estimate of the portion of the .016 growth of W_{co}/W_{hs} during this interval attributable to the increase in this deficit variable is between .0011 and .0017 (Bound, Johnson, and Stafford 1994).[8]

INSTITUTIONAL EXPLANATIONS

Several explanations for the rise in wage inequality focus on changes in wage-setting institutions. (Bluestone and Harrison [1988] offer an extensive discussion of the possibili-

Table 4
ESTIMATED PROPORTION OF EMPLOYMENT IN DURABLE GOODS/MINING AND LOGARITHMIC WAGE RENT
By Education

	Employment Proportion		Rent	
	1973	1988	1973	1988
Group				
Dropouts	.267	.125	.085	.112
High school	.196	.153	.068	.092
Some college	.161	.118	.073	.091
College +	.098	.106	.059	.155

Source: Data from Bound and Johnson 1992.

ties.) The change most commonly cited as a cause is the decline in union representation in the United States.[9] The reasoning is straightforward. If unions increase the wage rates of their members by 100M percent above the level they would achieve in the absence of representation, a general decline in the extent of unionism will lower the average wages of groups that initially had high union representation.[10]

The problem with this argument is that it ignores the effects of union wage policy on nonunion wages. If a set of jobs usually performed by a particular type of labor is unionized and the employer forced to pay higher wages, the supply of labor to all other jobs done by that type of labor will increase with a concomitant reduction in wages. It is thus not clear if the average wage for the group rises or falls with the increase in union representation.[11] The qualitative effects of a fall in union representation, such as occurred at an accelerating rate in the 1980s, are similarly unclear.[12]

TECHNOLOGICAL CHANGE

Several investigations of the rising inequality phenomenon have concluded that the principal reason for the rightward shift in the relative demand function is skill-biased technological change (for example, Mincer 1987, Johnson and Bound 1992, and Topel 1994). Many studies have found that there is much greater shifting of relative demand functions within industries than between industries (Davis and Haltwinger 1991; Berman, Bound, and Griliches 1994). Other studies have shown a direct link between the introduction of "information capital" and the skill composition of demand (Berndt, Morrison, and Rosenblum 1992) and between individual wages and on-the-job use of computers (Krueger 1991).

Our suspicion is that a secular shift in production functions in favor of workers with relatively high intellectual as opposed to manual ability—a process that accelerated during the 1980s because of computers—is responsible, in concert with the slowdown of the growth in the relative supply of skilled labor, for most of the wage phenomena that have been observed.[13]

The obvious problem with this view is that the

evidence in favor of it is largely circumstantial; it is very difficult to claim to have found a "smoking gun" in what is essentially an argument involving residuals. The relative demand function, however, has been shifting to the right for a long time (as pointed out in Welch 1970). For example, our skill supply index in Table 3 grew at an average annual rate of .032 from 1940 to 1993. In order for the 1993 college/high school relative wage to be roughly equal to its 1940 value, the relative demand function would have to shift to the right by over 400 percent. At the risk of arguing tautologically, the source of this shift has to be technology.

CONCLUDING REMARKS

As we noted in the opening section of the paper, the consensus on the "story" of rising wage inequality in the 1980s (and into the 1990s) will not be decided definitively until ten to twenty years of additional data are available. In our view, the relative demand for skill function will continue to shift to the right at a fairly rapid rate—although probably not as rapidly as it appeared to shift in the 1980s.[14] Thus, the future rate of growth of the skill differential will depend on whether the supply of skills grows more or less rapidly than the position of the demand-for-skills curve.

We have done some preliminary work on the construction of a model to forecast the relative supply of skill and thus, conditional on the rate of growth of the demand curve shift parameter, changes in the skill differential. Space does not permit a discussion of the model here,[15] but it is clear from recent data on both the age distribution of educational attainment and school enrollment rates that the next ten years will not be characterized by an unusually high rate of growth in the supply of skills.

1. A seemingly related development, first noticed by Juhn, Murphy, and Pierce (1993), is the increase in within-group variance that, unlike the educational differential, began increasing in the 1970s and continued into the 1980s. The standard deviations of log wages within education/experience/gender groups for whites were about the same in 1993 as they were in 1988—although much larger than in 1979. Much further work will be done on this question, but we take this result as suggesting that within-group variance has, at least temporarily, stopped growing.

2. The growth rates of wages and salaries for white- and blue-collar workers in the Bureau of Labor Statistics employer cost index, which is based on data from firms, were very similar to those implied by (2) and (4) in Table 2. In the 1988-93 period, about a third of the increase in the relative wages of white-collar workers was attributable to the fact that the fringe benefits of blue-collar workers grew more rapidly than those of white-collar workers (a fact that was not true in the 1980s).

3. This is based on the assumption that dropouts produce 80 percent of the services of high school graduates and that an individual with some college produces half a unit of high school services and half a unit of college services. Katz and Murphy's weights were $\mu_{so} = .29$, $\lambda_{do} = .93$, $\lambda_{do} = .29$, with the addition of $\mu_{do} = -.05$. The rates of growth of s with their weights are similar to those with our weights except in the 1988-93 interval (because our assumption gives more skill weight to those with some college, the labor force weight of which grew rapidly). Among the other possible specifications of the labor aggregation are that of a constant elasticity of substitution between different demographic groups (Bound and Johnson 1992) and the most general case of different partial elasticities of substitution between different groups (Murphy and Welch 1992).

4. The large rate of growth of s in the 1973-79 interval was, in fact, abnormal (largely caused by the demand for draft deferments during the late 1960s). The .029 rate of growth in s in the 1979-88 period was in line with the past trends. (For example, data from Goldin and Margo [1992] indicate that the rate of growth of s for white males during both the 1940s and 1950s was .031.) Thus, had there been no temporary increase in the growth of s in the 1970s, the college/high school wage would have started to increase in that decade rather than decreasing slightly.

5. Further, during the 1980s and 1990s, women apparently experienced a larger increase in their productivity relative to men in "men's jobs" than in "women's jobs," a development that, among other things, would tend to lower the average productivity and wages of men (see Johnson and Stafford 1994). These phenomena may explain the result of Topel (1994) that low-skilled men and high-skilled women are substitutes in production.

6. See Topel (1994) and Jaeger (1994).

7. Murphy and Welch (1991) also focus on this variable.

8. A considerably large fraction (up to one-fourth) of the observed increase in the college/high school relative wage is potentially attributable to the durable goods trade deficit.

9. See, for example, Dinardo and LeMieux (1993), who study inequality among males, and Even and MacPherson (1993), who attribute one-seventh of the decline in the gender gap to the decline in unionization.

10. Let w_i, w_{in}, and w_{iu} be logarithms of the average, the nonunion, and the union wage for group i workers and U_i the proportion in union jobs. Since $w_{ui} = W_{ni} + M$, the logarithm of the average wage of group 1 relative to group 2 workers is $W_1 - W_2 = W_{n1} - W_{n2} + M(U_1 - U_2)$. If there is a proportional decrease in union representation across all groups, $w_1 - w_2$ will—if the w_{ni}'s stay constant—rise if $U_2 > U_1$.

11. In terms of the previous footnote, w_l rises or falls with an increase in union representation of one worker as the wage elasticity of demand for labor by job is less or greater than one.

12. Goldin and Margo (1992) argue that institutional factors (the policies of growing unions and the War Labor Board) were a major factor in the compression of wages during the 1940s. Given that unemployment was very low in the latter half of that decade, it is unlikely that unions caused large distortions in average wages by skill, an effect that would require that union wage levels had a positive spillover effect on nonunion wages for blue-collar labor (thus causing structural unemployment). No such argument, of course, applies to the semicontrolled wartime labor market of the first half of that decade.

13. A fact that does not easily fit into the technological change story is the finding of Pierce and Welch (1994) that a large part of the increase in the returns to college during the 1980s was "in actuality an increased premium for college education put to use in the business and law fields." They report that the wages of computer specialists and engineers actually fell relative to high school graduates during this period.

14. For example, Goldin and Margo (1992) document that the large increase in the durable goods sector (spurred initially by World War II and then by the demand for new products) contributed significantly to the compression of skill differentials. Something like that—although hopefully not World War III—may happen in the next twenty years. Mincer (1994) suggests that the decline in research and development during the 1980s (due largely to a decline in defense expenditure) may reduce the future rate of shift of the relative demand function. The fact

that the growth rate of skill differentials declined in the 1988-93 period in the face of roughly the same supply growth as in the 1979-88 period is consistent with Mincer's view.

15. A major limitation of such a model is that its results are fairly sensitive to the way in which groups with different demographic characteristics (education, age, and gender) are aggregated into skill

Note 15 continued

categories. What are the "correct" partial elasticities of complementarity between, for example, high school graduates, those with some college, and college graduates, or between men and women of the same age/education levels? The present empirical answers to these questions have fairly wide confidence intervals.

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U.S. Wage Trends in the 1980s: The Role of International Factors

Robert Z. Lawrence*

United States wage performance has been disquieting. Between 1979 and 1993, real hourly compensation rose by just 5.5 percent. This poor average wage performance has been associated with a dramatic increase in the dispersion of earnings: both in the returns to general characteristics such as education, experience, and occupation and in earnings across workers with similar educational, experience, and occupational characteristics.[1] In this paper I will consider briefly the evidence on the role that U.S. international performance has played in these outcomes.

AVERAGE WAGES

Three internationally related explanations have been advanced to account for the poor average growth in U.S. wages over the 1980s. These can be described as deindus-

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trialization, relative decline, and factor-price equalization. But the evidence supports none of these explanations. Instead, poor average compensation reflects the sluggish rise in U.S. labor productivity, which results from poor productivity performance outside the manufacturing sector.

DEINDUSTRIALIZATION

The deindustrialization hypothesis suggests that the U.S. trade deficit in manufactured goods has eroded the supply of highly paid manufacturing jobs. But the job content of the U.S. manufacturing trade deficit that emerged over the 1980s is simply too small to allow the explanation for slow average wage growth to be the loss of high-paying manufacturing jobs due to trade. In 1991, the trade deficit was equal to about 5 percent of value-added in manufacturing. Average hourly earnings in manufacturing were 8.2 percent higher than those in the private sector generally. (Average weekly earnings were 29 percent higher.) Since manufacturing accounted for 17 percent of total employ-

ment, shifting an additional (.05 * 17) 0.85 percent of employment to manufacturing would have raised average hourly and weekly wages by 0.07 and 0.25 percent, respectively—an amount scarcely large enough to explain the poor wage performance of the 1980s.

DECLINE

Nor is there support for the decline hypothesis. Stafford and Johnson suggest that an erosion of the rents from U.S. technological leadership explains the slow growth in U.S. wages over this period. But such an erosion in the international buying power of U.S. wages (and profits) should be associated with a decline in the terms of trade. However, while there is evidence of such a decline in the 1970s, over the 1980s, the broadest measure of the terms of trade—using the GDP deflators for exports and imports of goods and services—shows an improvement of 5.2 percent, while the fixed-weight price measures show an increase of 1.5 percent.

FACTOR PRICE EQUALIZATION

Finally, the claim of factor price equalization for all U.S. wages put forward by Leamer (1991) also does not stand scrutiny. U.S. compensation per worker actually increased in line with output per worker. When nominal compensation is deflated by a production price index (in this case the business sector GNP deflator) rather than by the consumer price index, this "production wage" closely tracks the growth in output per worker from 1979 to 1991. If the factor price equalization between wages and capital was occurring, real product wages would be growing more slowly than productivity.[2]

The evidence instead indicates that had American workers chosen to consume the products they produced, their real compensation would have increased by about 10 percent over the 1980s—about as much as output per worker in the business sector. However, as elaborated in Lawrence and Slaughter (1993), real wage growth lagged behind productivity growth for two main reasons: (a) much of the productivity growth occurred in industries producing capital goods such as computers, which workers do not generally buy, and (b) the relative price of housing

(which workers consume but do not produce) rose. International trade played no role in this poor average wage growth.

INCREASING DISPERSION

Other analysts have suggested that trade (or globalization) helps explain the growing inequality in U.S. wages. In particular, they point to the correlation between rising wage inequality and the growing U.S. trade deficit (Murphy and Welch 1992; Borjas and Ramey 1993). Many argue that trade with developing countries is putting downward pressure on the relative wages of unskilled workers.

QUANTITIES

Studies that have tried to quantify the relationships more precisely, however, have generally concluded that the impact of trade is small. In particular, Borjas, Freeman, and Katz (1992, p.237) estimate the quantities of educated and uneducated labor embodied in U.S. manufactured goods exports and imports. They conclude that trade flows explain at most 15 percent (that is, 1.9 percentage points) of the 12.4 percent increase between 1980 and 1988 in the earnings differential between college-educated workers and their high-school-educated counterparts. Since the trade deficit has declined considerably since 1988, a similar estimate today would yield smaller effects.

U.S. imports from developing countries did increase rapidly over the decade, but again what needs to be borne in mind is the magnitude. In 1990, for example, these imports amounted to $115.8 billion, or 2.1 percent of U.S. GNP, versus 1.2 percent in 1981. It is hard to see how a change of this magnitude—less than 1 percent of GNP—could have a large impact on the overall labor market.[3] Jeffery Sachs and Howard Shatz (1994) estimate that trade with developing countries reduced U.S. manufacturing employment by 5.7 percent between 1978 and 1990—a number that is just over 1 percent of aggregate U.S. employment. They find that such trade induced a 6.2 percent decline in production worker employment in manufacturing and a 4.3 decline in nonproduction workers, suggesting little impact on the economy-wide relative demand for these two occupational categories.[4]

PRICES

There is a problem in using ex post trade flows to make these calculations. Such flows do not necessarily capture the effect of price pressures that operate through trade.[5] If international competition forced U.S. workers to lower their wages, for example, domestic firms might be able to prevent imports from rising. By examining only trade flows, as these calculations do, we would conclude that trade had no impact on wages. In principle, therefore, even if trade flows are small, changes in traded goods prices could have large effects on the prices (and thus factor returns) of domestically produced substitutes. As Bhagwati (1991) has emphasized, relative price changes are the critical intervening variable in the chain of causation from trade to factor prices.

If trade lowered the relative wages of unskilled workers, according to the Stolper-Samuelson theorem, we would expect to see a decline in the relative price of goods that are produced using unskilled labor relatively intensively. In Lawrence and Slaughter (1993), however, my coauthor and I find that over the 1980s, the relative import and export prices of unskilled-labor-intensive goods actually increased slightly.

As might have been anticipated given its surprising conclusions, our work has been attacked. Sachs and Shatz (1994) raise questions about our use of the price data. In particular, they argue that computer prices should not be included in the sample. When they drop computers, they obtain a negative but statistically insignificant relationship between import price changes and skill intensity and they note that the size of the effect is small. Similarly, if computer price changes are omitted, the ratio of manufacturing producer prices weighted by production worker employment to prices weighted by nonproduction workers falls slightly instead of rising slightly. While we would agree that computer prices are difficult to measure, we are not convinced that this sector should be given no weight at all in the explanation. Even accepting their evidence indicates only a small relative decline in the prices of unskilled-labor-intensive products.[6]

Moreover, in Lawrence (1994) I report similar investigations of the price behavior of both German and Japanese imports and producer prices. These data tell the same story: when price changes over the decade of the 1980s are regressed against the ratio of unskilled to skilled employment, they indicate a positive rather than negative relationship (which is statistically significant in the case of wholesale prices but not import prices). Similarly, when industry wholesale and import prices for both countries are weighted by production worker shares, they show larger increases (or smaller declines) than when weighted by nonproduction workers. These results are robust to including or dropping computer prices from the samples.

In Lawrence and Slaughter we also noted that if trade was the operative factor, we would expect to see a contraction in labor-intensive industries, but we would also expect to see the remaining sectors taking advantage of this labor by using unskilled labor relatively more intensively. In fact, throughout U.S. manufacturing, there has been a pervasive upward shift in the ratio of skilled to unskilled labor.[7] Our conclusion, therefore, is that the simple Stolper-Samuelson process due to trade does not provide an adequate account of the growing wage inequality. Instead, we interpret the evidence as consistent with a bias in manufacturing technology toward the more intensive use of skilled labor. Our conclusion is supported by Berman, Bound, and Griliches (1992) and Bound and Johnson (1992), who find that trade played basically no role in America's wage changes in the 1980s and ascribe these changes to technological change and changes in unmeasured labor quality.

Mishel and Bernstein (1994) question whether the shift toward the relatively more intensive use of skilled labor in the 1980s is any greater than it was in earlier decades. In fact, the shift toward the more intensive use of nonproduction labor in the 1980s was both larger and more pervasive than in the 1970s and 1960s. As I elaborate in Lawrence (1994), the average decrease in the ratio of production to nonproduction workers across three-digit industries was 18.47 percent in the 1980s, compared with 6.9 and 7.23 percent in the 1960s and 1970s, respectively. Of course an increase in the manufacturing average could reflect a change in either the mix of industries or the ratio within industries. Both factors were at work. However,

69.7 percent of the shift occurred within industries. Since this shift occurred even though relative wages of nonproduction workers actually increased, it is strongly suggestive of a skilled-labor-using technological shift that was concentrated in the skill-intensive sector of manufacturing.

EVIDENCE FROM U.S. MULTINATIONALS

Additional support for these conclusions can be found in an examination of U.S. multinational data (Table 1) (Lawrence 1994). It is widely perceived in the United States that many of the jobs formerly in these firms have moved abroad. Drawn by low labor costs and low labor standards, multinational corporations are seen as having relocated their production toward low-wage countries. In particular, the jobs of blue-collar workers are viewed as vulnerable to this development. Such international outsourcing could, in principle, provide an alternative explanation of the widespread decline in *both* relative blue-collar wages and the ratio of blue- to white-collar workers employed in U.S. manufacturing.

If outsourcing is important, the decline in blue-collar intensity in the United States should be associated with an increase in blue-collar intensity abroad. In addition, as viewed through the eyes of the Stolper-Samuelson paradigm, if developing countries lower their trade barriers and increase their specialization in unskilled-labor-intensive products, the relative wages of production workers should rise in developing countries, while in developed countries they should fall. On the other hand, if global changes in technology are dominant, we should see *parallel* increases in the ratio of blue- to white-collar employment in the United States and in the rest of the world and similar movements in wages.

The ratio of production to nonproduction workers employed in U.S. manufacturing operations worldwide has fallen precipitously. Indeed, the declines are of similar magnitude in U.S. manufacturing parents (-15.7 percent) and in their affiliates in developing countries (-13.6 percent). The declines have been particularly large in Europe (-24.2 percent) and in Australia, South Africa, and New Zealand (-19.1 percent). In addition, the relative wages of production workers have fallen worldwide—in U.S. subsidiaries

in both the developed and the developing economies. The picture that emerges supports the notion of a common shift in technology rather than the notion of expanding trade. *Worldwide* (in both developed and developing countries), we see a rise in the relative employment of nonproduction workers despite the increase in their relative wage.[8]

TECHNOLOGICAL CHANGE

Mishel and Bernstein question whether this change in skill intensity should be described as technological change. They find an absence of evidence indicating an association with investment and other hard measures of technical change such as research and development, capital accumulation, and computerization, and they stress the importance of distinguishing developments in manufacturing from those in the rest of the economy.

Both the points they make are important. First, if this evidence is correct, those arguing for a major role for technology must apply a broader interpretation that includes new labor-management relations and work organization. Second, the divergent productivity performance between the manufacturing and services sectors in the United States is a major structural feature of the U.S. economy in the 1980s. Historically, relative productivity growth was faster in goods than in services. But this difference widened in the 1980s, when almost all the improvement in total factor productivity in the business sector was confined to manufacturing (Gullickson 1988). If the demand for manufacturing goods is inelastic, relatively rapid increases in manufacturing productivity will reduce the demand for manufactured goods workers. With no bias in this change, since production workers are relatively intensively employed in manufacturing, this will reduce the demand for production workers. In combination with a shift within manufacturing toward production-worker-saving technical change concentrated in nonproduction worker sectors, the impact on relative wages could be considerable.

There remains the issue of whether technological change itself has been affected by trade. It is noteworthy that while U.S. productivity growth in manufacturing recovered in the 1980s, it did not exceed the pace it had

achieved before 1973. This could reflect a spur from international competition offsetting a more general slowdown, or it could simply reflect a return to previous performance. More generally, however, the links between trade pressures and productivity growth have not been adequately explored.

U.S. MULTINATIONALS

| | Employment Figures (000s) | | | | | | | | | Employment Ratios | | | Compensation Ratios | | |
| | Total | | | Production Workers | | | Nonproduction Workers | | | Production Worker Employment/ Nonproduction Worker Employment | | | Production Worker Compensation/ Nonproduction Worker Compensation | | |
	1977	1989	Percent Change	1977	1989	Percent Change	1977	1989	Percent Change	1977	1989	Percent Change	1977	1989	Percent Change
THE UNITED STATES[a]															
Total[b]	67,344	90,644	34.6	55,179	73,474	33.2	12,165	17,170	41.1	4.54	4.28	-5.7	-[c]	-[c]	-6.8
Manufacturing	19,682	19,426	-1.3	14,135	13,257	-6.2	5,547	6,169	11.2	2.55	2.15	-15.7	N.A.	N.A.	-
MULTINATIONALS[d]															
Total	18,885	18.765	-0.6	N.A.	N.A.	-	N.A.	N.A.	-	N.A.	N.A.	-	N.A.	N.A.	-
Manufacturing	11,775	10,127	-14.0	7,257	N.A.	-	4,518	N.A.	-	1.61	N.A.	-	0.78	N.A.	-
FOREIGN AFFILIATES[e]															
Majority-owned manufacturing affiliates in:															
Developed countries	2,754	2,167	-21.3	1,695	1,196	-29.5	1,059	971	-8.3	1.60	1.23	-23.1	0.75	0.66	-10.8
Canada	562	455	-19.2	358	274	-23.5	204	181	-11.5	1.76	1.52	-13.6	0.86	0.81	-5.2
Europe	1,951	1,509	-22.6	1,202	828	-31.1	749	681	-9.1	1.60	1.22	-24.2	0.70	0.63	-10.0
Japan	40	75	86.6	14	23	62.0	26	52	99.7	0.53	0.43	-18.9	0.75	0.69	-8.5
Australia/New Zealand/ S. Africa	201	129	-35.8	122	71	-41.3	80	58	-27.4	1.53	1.23	-19.1	0.78	0.68	-12.5
Developing countries	1,019	1,079	5.9	675	679	0.6	344	400	16.4	1.96	1.70	-13.6	0.47	0.41	-12.8
Total	3,773	3,247	-14.0	2,371	1,875	-20.9	1,403	1,371	-2.2	1,69	1.37	-19.1	0.68	0.59	-14.2
Majority-owned manufacturing affiliates in:															
Food & kindred products	377	308	-18.5	248	184	-25.9	129	124	-4.2	1.93	1.49	-22.7	0.57	0.62	9.8
Textile products & apparel	102	82	-19.5	80	59	-27.2	21	23	9.3	3.78	2.52	-33.3	0.47	0.59	23.7
Chemicals & allied products	464	475	2.2	233	227	-2.5	231	247	6.9	1.01	0.92	-8.8	0.71	0.64	-9.1
Primary & fabricated metals	229	179	-21.9	158	117	-26.1	71	62	-12.5	2.23	1.88	-15.6	0.80	0.73	-9.4
Machinery, except electrical	523	508	-2.9	270	254	-6.0	253	254	0.4	1.07	1.00	-6.4	0.61	0.59	-3.9
Electric & electronic equipment	629	455	-27.7	422	288	-31.8	207	167	-19.3	2.03	1.72	-15.5	0.56	0.54	-4.3
Transportation equipment	740	597	-19.4	507	365	-28.0	233	231	-0.9	2.17	1.58	-27.3	0.97	0.61	-37.2
Other manufacturing	709	645	-9.0	452	382	-15.5	257	263	2.3	1.76	1.45	-17.4	0.75	0.59	-21.0
Total	3,773	3,247	-14.0	2,371	1,875	-20.9	1,403	1,371	-2.2	1.69	1.37	-19.1	0.68	0.59	-14.2

[a] Labor force totals according to the U.S. Department of Labor, *Employment, Hours, and Earnings, United States, 1909-90,* vol. 1.

[b] Figures for private nonfarm establishments. The total nonfarm figures are: 1977–82.471 million; 1989–108.413 million.

[c] The compensation ratio for total U.S. employment is a comparison of the white-collar/blue-collar cost indices in 1977 and 1989, as published by the Bureau of Labor Statistics.

[d] According to and based on U.S. Department of Commerce publications: *1977 U.S. Direct Investment Abroad*; *1989 U.S. Direct Investment Abroad.* Information is for nonbank U.S. parents of nonbank U.S. affiliates.

[e] Classified by industry of affiliate. According to the Department of Commerce publications referenced above.

SPECIFIC FACTORS

Wages will reflect the returns to both general and firm-and/or industry-specific human capital. Those invoking theoretical frameworks such as that of Hecksher-Ohlin implicitly have in mind explanations of changes in the returns to general human capital. To argue, as we have done, that there is little evidence in support of the Hecksher-Ohlin framework, therefore, should not be interpreted to mean that trade has had no impact on the returns to industry-specific capital. In fact, early work by Lawrence and Lawrence (1985) and later work by Revenga (1992) and Borjas and Ramey (1993) suggest that trade has had some impact on relative industry rents.[9] Thus, trade performance has an impact on specific returns and rents but the degree to which these effects are associated with more general attributes remains unclear.

CONCLUDING COMMENTS

Why U.S. productivity growth in services has risen so slowly since 1973 remains a great mystery. But taking this performance as given, there is no mystery in the slow growth in average U.S. compensation. A complete accounting of the growing dispersion in U.S. wage performance requires the integration of many different factors, and the size of the changes suggests that a variety of causes could be important. In this short note, however, I have concentrated on the role of international trade and investment. I conclude that trade has had some impact on relative industry wages but provides little explanation for the growing dispersion in the returns to general factors such as education, skill, and occupation. Certainly, support for those invoking the factor-price equalization theorem is very weak.

l. Bound and Johnson (1992) found that between 1979 and 1988, the ratio of the average wage of a college graduate to the average wage of a high school graduate rose by 15 percent. Steven Davis (1992) found that between 1979 and 1987, the ratio of weekly earnings of males in their forties to weekly earnings of males in their twenties rose by 25 percent. The employment cost index indicates that between December 1979 and December 1992, the growth of compensation and earnings of white-collar occupations exceeded that of blue-collar occupations by 7.9 and 10.9 percent, respectively. Katz and Murphy (1992) and John, Murphy, and Pierce (1993) emphasize the changes within industry-occupation cells.

2. In addition to arguing that trade has reduced average U.S. wage rates, Leamer (1991) argues that trade has lowered the relative wages of unskilled workers. This claim will be discussed below.

3. U.S. exports to developing countries have also grown rapidly. Over the 1980s, the U.S. trade deficit in manufactured goods trade with developing countries swung by $45.55 billion or 8/10 of a percent of GDP.

4. Adrian Wood (1994) has questioned the use of developed country input coefficients for imports from developing countries.

5. Deardorff and Staiger (1988) demonstrate the conditions under which this methodology is appropriate. It is necessary that both preferences and production technology are Cobb-Douglas.

6. Sachs and Shatz also claim on the basis of their regressions omitting the computer industry that there was a negative relationship between total factor productivity growth and skill intensity. They conclude "TFP growth was less on average in high-skilled than low-skilled industries" and argue that technological change was therefore causing wage differentials to narrow rather than widen. Again, the impact of the computer industry is important. In Lawrence and Slaughter, we found that, including computers, the gap between weighted averages of high-skilled and low-skilled productivity growth was positive, and thus concluded the impact was the opposite.

8. Davis (1992) similarly rejects the prediction that relative factor prices are converging internationally.

9. The international evidence is more mixed. Using an international sample, Martins (1993) finds import penetration reduces relative wages in competitive sectors such as textiles and clothing but actually increases relative wages in sectors with product differentiation. Wyploz (1994) obtains similarly complex results.

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Inequality in Labor Market Outcomes: Contrasting the 1980s and Earlier Decades

Chinhui Juhn and Kevin M. Murphy*

Wage inequality for males in the United States increased dramatically during the 1980s. Between 1979 and 1990, the weekly earnings of college graduates increased by 2 percent while the real weekly earnings of high school graduates decreased by more than 16 percent. As a result, the wage premium for college graduates increased from 42 percentage points in 1979 to 71 percentage points in 1990. Changes within schooling levels were equally dramatic. Consequently, overall wage inequality for men grew dramatically between 1979 and 1990. Wages for men at the top end of the wage distribution grew by 18 percent relative to wages for men at the bottom of the wage distribution over the 1980s.

These increases in inequality have been widely dis-

cussed and described (see, for example, Murphy and Welch 1989, 1992; Blackburn, Bloom, and Freeman 1989; and Levy and Murnane 1991). In this paper we put the recent rise in inequality in a longer term perspective by looking at changes in inequality and other labor market outcomes between 1939 and 1989 using data from the Decennial Census and the Current Population Survey. As others have found (see Goldin and Margo 1991), the rise in inequality witnessed during the 1970s and 1980s stands in sharp contrast to the dramatic fall in wage inequality during the 1940s and the relative stability of wage inequality during the 1950s and 1960s. In addition, we find that other factors such as the patterns of changes in employment rates for men and their spouses, which have tended to reinforce the impact of growing wage inequality on individual and family earnings during the 1980s, also behaved quite differently in earlier decades.

When we look at potential demand- and supply-side factors that might explain the recent rise in wage inequality, the contrasts are much less striking. This seems

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important, since most researchers associate the rise in inequality with a rise in the relative demand for skilled workers (see, for example, Bound and Johnson 1991, Murphy and Welch 1992, Juhn, Murphy, and Pierce 1993). When we look at supply-side factors, we find that differential supply growth across decades seems relatively unimportant, except for the 1970s when rapid growth in the college population depressed wages for college graduates relative to their less educated counterparts. We look at demand-side changes using changes in the industrial and occupational mix of the economy as a proxy for the underlying shifts in labor demand. One might expect from the wage evidence that employment in the skill-intensive industries and occupations grew much faster during the 1980s than in earlier decades. Contrary to such expectations, however, we find that overall, the relative demand for skill (as measured by our demand index) grew no faster during the 1980s than during the 1940s. At least as measured by employment shifts across different industries and occupations, the evidence suggests that the U.S. economy has been moving toward more skill-intensive jobs relatively steadily since 1940.

What does distinguish the 1940s and the 1980s is the *composition* of the change in relative demand for skill. In particular, the shift in the demand for skills has been increasingly concentrated among the highest skill levels during the recent decades. This change in the nature of skill demand is associated with an accelerated shift in demand toward more skilled workers within, rather than between, industries.

The next section contrasts the changes in wage inequality and employment for men and their spouses during the 1980s and prior decades. We then present evidence on supply and demand factors for the 1940-90 period.

CONTRASTS IN WAGES AND EMPLOYMENT

Table 1 presents data on changes in real wages for men and employment rates for men and their spouses from 1940 to 1990. The data are from the 1940-80 Public Use Micro Samples (PUMS) and from the 1988-92 March Current Population Surveys. To examine wage changes, we selected a sample of white males with one to forty years of potential

labor market experience who worked full-time in the nonagricultural sector, were not self-employed, worked a minimum of forty weeks, and earned at least one-half of the legal minimum weekly wage.

The top panel presents the decade changes in log weekly wages of men in different quintiles of the wage distribution. Changes in the average wage and in the relative wage (here defined as the differential between the top and the bottom quintile wages) are presented in the bottom rows of the three panels in the table. As the top panel shows, confirming what others have found before, wage inequality declined dramatically during the 1940s, with the wage differential between the top and the bottom quintiles of the distribution falling more than 20 percent over the decade. Since the 1940s, there have been progressively larger increases in wage inequality, with the differential between the top and bottom quintiles growing 9.5 and 11.5 percent, respectively, during the 1960s and the 1970s. The most significant increase in male wage inequality, however, occurred during the 1980s, with the top quintile gain-

Table 1
WAGE GROWTH AND EMPLOYMENT BY WAGE PERCENTILE
1940-90

	Real Wage Growth				
Percentile	1940-50	1950-60	1960-70	1970-80	1980-90
11-20	.315	.278	.192	-.015	-.169
21-40	.277	.292	.207	.015	-.116
41-60	.197	.301	.232	.073	-.072
61-80	.127	.302	.252	.096	-.024
81-90	.091	.300	.284	.089	.011
1-100	.194	.297	.241	.050	-.078

	Employment Rates					
Percentile	1940	1950	1960	1970	1980	1990
1-20	.689	.844	.818	.849	.771	.759
21-40	.727	.917	.915	.943	.890	.874
41-60	.858	.934	.953	.955	.926	.918
61-80	.922	.950	.951	.962	.943	.945
81-100	.947	.951	.960	.960	.949	.952
1-100	.829	.920	.921	.920	.881	.884

	Employment Rates for Wives				
Male Wage Decile	1940	1960	1970	1980	1990
1-20	.149	.326	.437	.511	.598
21-40	.153	.320	.440	.555	.678
41-60	.144	.293	.409	.550	.688
61-80	.138	.262	.376	.522	.666
81-100	.122	.194	.306	.471	.610

ing more than 23 percent relative to the bottom quintile.

The top panel also illustrates the sharp contrast across decades in the overall rate of wage growth. Real wages for men grew between 20 and 30 percent per decade between 1940 and 1970. During the 1970s, however, they grew only 5 percent, and they actually declined by more than 7 percent during the 1980s. As a result, the contrast in real wage performance for our lowest wage group of men between the earlier decades and the 1980s is even greater than the contrast in inequality growth. Real wages for these men increased at an average rate of about 2.6 percent per year (26.2 percent per decade) between 1940 and 1970 but declined at annual rates of 1.5 percent per year during the 1970s and 1.69 percent per year during the 1980s. Hence the contrast in overall wage growth between the 1980s and earlier decades accentuates the effect of the difference in inequality growth across these same time periods.

The middle panel of Table 1 looks at employment rates for these same men over the 1940-90 period. Once again, the contrasts across decades are striking. Overall, employment rose between 1940 and 1950, was steady from 1950 to 1970, and then fell sharply over the 1970s before stabilizing during the 1980s. However, once again we find the contrast across decades to be greatest for the least skilled men. Employment rates for the lowest wage group of men were 16 percentage points higher in 1970 than in 1940 and 3.1 percentage points higher in 1970 than in 1960, while employment rates of high-wage men were only 1.3 percentage points higher in 1970 than in 1940. Hence the large gains in employment for men over the 1940-70 period were greatest for men in the lowest wage categories. In contrast, low-wage men have fared the worst over the recent period. Between 1970 and 1990 the employment rate for the bottom quintile of men declined by 9 percentage points, while the employment rate of high-wage men declined by less than 1 percentage point. Hence the contrasts in employment growth, like the contrasts in overall wage growth, reinforce the effects of wage inequality on the labor market outcomes for low-skilled men.

The bottom panel of Table 1 examines data on the employment rates of wives of men in each of the same wage quintiles. (Data for 1950 are missing since the sampling structure of the 1950 census file prevents us from matching husbands and wives for these purposes.) Once again, the contrasts across decades for men in the various wage deciles are striking. Between 1940 and 1960, employment rates for the wives of men in the lowest wage decile increased by 17.8 percentage points, while employment rates for the wives of men in the highest wage decile increased by only 5.2 percentage points. The 1960s were characterized by a relatively neutral increase in female participation, with the employment rate of all groups of wives increasing between 10 and 13 percent. The data for the 1970s and 1980s are strikingly different. Between 1970 and 1990, employment rates for the wives of men in the lowest wage decile increased by only 13.4 percentage points, while the employment rate for wives of men in the highest wage decile increased by 31 percentage points. In fact, employment rates for wives of men in the lowest wage decile grew faster between 1940 and 1970 (9.4 percentage points per decade) than between 1970 and 1990 (6.7 percentage points per decade), while employment growth accelerated for wives of high-wage men. Hence, once again we see contrasts between the 1980s and earlier decades that go in the same direction (toward growing disparity) as the recent changes in wage inequality.

The net impact of these changes in real wages, own employment growth, and growth in spouse's participation on the growth in family earnings by male wage decile is illustrated by Chart 1. These figures contrast the story for the recent decades with that for the 1960s. The top panel of Chart 1 gives the combined earnings of the husband and wife for married men by male wage decile for 1970 (the leftmost bar) and 1990 (the rightmost bar), along with a hypothetical family earnings number that holds the wife's real earnings constant at their 1970 value. Hence, moving from the leftmost bar to the center bar gives the impact of changes in the husband's earnings, while moving from the center bar to the right bar gives the impact of changes in the wife's earnings. As the chart demonstrates, the decline in male employment and wages reduced earnings for men in the lowest wage deciles, while changes in their wives' earnings served to hold overall fam-

ily earnings constant. The changes for men in the middle wage deciles show that male earnings were roughly constant, with all the increase in family earnings coming from growth in the earnings of the wife. At the top end, wives of high-wage men have contributed roughly the same amount to the growth in family earnings as has the growth in their husbands' earnings.

The bottom panel of Chart 1 shows the corresponding changes for the 1960s. During the 1960s, male earnings grew substantially (and by about the same percentage amount) for men at all points of the wage distribution, while changes in the earnings of wives contributed a roughly equal absolute amount (and hence a substantially greater percentage amount) to the growth in family incomes at all percentiles of the male wage distribution.

As Table 1 and Chart 1 make clear, the growth in wage inequality during the 1980s as well as the 1970s has been accompanied by many factors that exacerbate its impact on the incomes of low-wage households. The overall

Chart 1

Components of Family Earnings

Thousands of 1982 dollars

1970-90

| | Actual earnings 1970 | Hypothetical earnings 1990 | Actual earnings 1990 |

1-10 11-20 21-30 31-40 41-50 51-60 61-70 71-80 81-90 91-100

Thousands of 1982 dollars

1960-70

| | Actual earnings 1960 | Hypothetical earnings 1970 | Actual earnings 1970 |

1-10 11-20 21-30 31-40 41-50 51-60 61-70 71-80 81-90 91-100

growth in real wages has been much slower than during earlier decades, so that the decline in relative wages for less skilled workers has meant large absolute declines in real wages for these men. Male employment in these households has declined, in contrast to earlier decades when it rose, and employment levels for their wives have increased slowly during the 1970s and 1980s, measured relative to either the rates for this same group during prior decades or the rates for the wives of high-wage men during the 1970s and 1980s. In terms of labor market outcomes by skill level, the 1970s and 1980s contrast sharply with earlier decades.

CHANGES IN THE SUPPLY AND DEMAND FOR SKILLS

What accounts for the tremendous contrast in the growth of wage inequality and other labor market outcomes between the 1980s and earlier decades? One potential explanation for the more rapid growth in wage inequality during the 1980s is differences in the growth rate of the supply of skill. We address this question in Table 2, where we estimate the growth in the supply of workers in a particular skill category (again measured in wage quintiles) by multiplying that skill group's initial distribution over five educational categories (less than eight, eight to eleven, twelve, thirteen to fifteen, and sixteen or more years of schooling) by the aggregate changes in the educational distribution. The main finding to report from Table 2 is that explanations based on relative supplies will fall well short of accounting for the differences in wage inequality
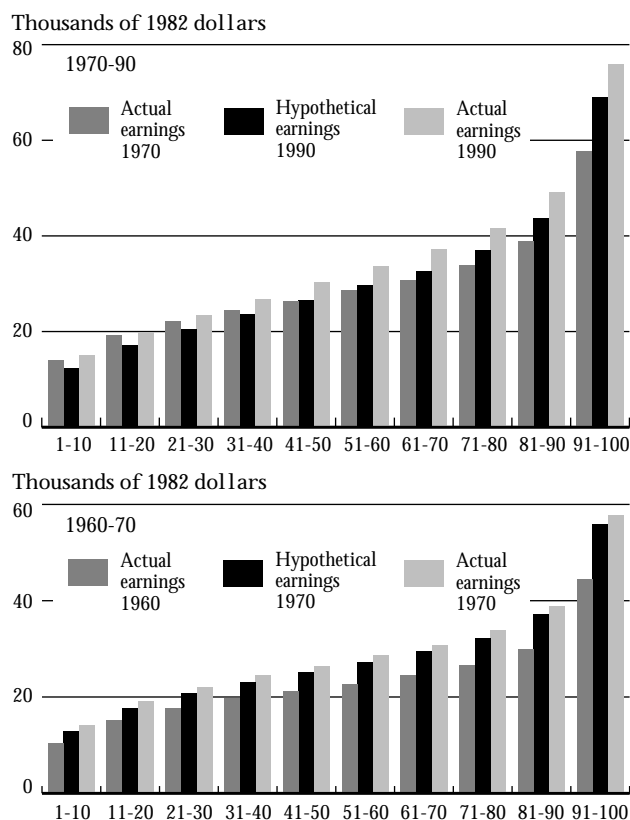
Table 2

CHANGE IN SUPPLY OF MEN BY WAGE PERCENTILE

	1939-49	1949-59	1959-69	1969-79	1979-89
Percentile					
1-10	-.06	-.10	-.15	-.16	-.11
11-20	-.04	-.07	-.10	-.14	-.07
21-40	-.01	-.03	-.05	-.08	-.03
41-60	-.00	-.01	-.00	-.03	.00
61-80	.01	.02	.04	.05	.03
81-90	.04	.06	.09	.13	.07
91-100	.09	.12	.17	.26	.12

Note: The change in supply reported above is predicted by multiplying the change in educational distribution across the decennial Censuses by the percentile group's initial distribution across five educational categories: less than 8, 8 to 11, 12, 13 to 15, and 16 or more years of schooling.

growth between the 1980s and earlier decades. In fact, compared with the later decades, the 1940s (the decade with the slowest growth in overall inequality) appears to be the decade of the slowest growth in the relative supply of skill, with the relative supply of the top quintile group growing 11 percent faster than that of the bottom quintile group. During the 1970s, the relative supply of the top quintile grew as much as 35 percent faster than the relative supply of the bottom quintile. Even though the relative supply of skill did not grow as dramatically dur-

ing the 1980s, the supply of the top group grew approximately 18 percent faster than that of the bottom group, a growth rate that is nevertheless significantly greater than the rate observed over the 1940s.

Differences in the rate of growth in the demand for skill represent another potential explanation. If such differential growth in the demand for skill is an important part of the explanation, then one would expect that demand for skill would have grown faster during the 1980s than in earlier decades. A starting point in testing this theory is to measure demand changes by assessing employment shifts across different sectors of the economy. A shift in overall aggregate employment toward more skill-intensive sectors would indicate a general increase in demand for skilled workers in the economy. Table 3 begins this analysis by examining employment distributions across different industries and occupations over the 1940-90 period. The table presents industry employment shares measured in labor efficiency units (see Katz and Murphy 1992). To measure demand changes, both men and women with one to forty years of labor market experience who have reported industry and occupation categories are included in the sample. For the sake of consistency, we concentrate on only the nonagricultural sector in our analysis.

The top panel of Table 3 indicates that the least skill-intensive industries, such as "low-tech" manufacturing, have been declining since at least 1940, with the share of employment falling from 12.5 percent in 1940 to 4.8 percent in 1990. Moreover, the declines in employment share are actually larger during the earlier decades (2.5 percentage points over the 1940s) than during the more recent decades (1.4 percentage points over the 1980s). In contrast, skill-intensive industries such as professional services have been rising rapidly every period, ending with an employment share of more than 23 percent by 1990.

The bottom panel of Table 3 presents employment shares across occupation categories. Again, the employment share of highly skilled occupations such as professionals increased every period, rising from 11.1 percent in 1940 to 23.5 percent in 1990. Low-skilled occupations such as laborers dropped in employment share from 7.8 percent in 1940 to 3.1 percent in 1990. Again, the larg-

Table 3
DISTRIBUTION OF EMPLOYMENT ACROSS INDUSTRIES
Excluding Agricultural Sector

	Across Industries					
	1940	1950	1960	1970	1980	1990
INDUSTRY						
Mining	2.9	2.2	1.5	1.2	1.5	0.9
Construction	6.2	7.2	7.2	6.7	6.7	6.8
Manufacturing						
Low-tech	12.5	10.0	9.7	7.5	6.2	4.8
Basic	13.0	16.1	17.9	17.1	15.3	12.5
High-tech	2.8	3.3	4.7	4.7	4.1	3.8
Transportation and utilities	10.0	9.9	8.4	7.9	7.9	7.3
Wholesale	3.9	4.7	4.4	5.0	5.1	4.8
Retail	18.1	16.6	14.1	13.0	12.1	12.5
Professional services and FIRE	9.4	9.8	12.4	15.4	19.1	23.6
Education and welfare	5.3	5.1	7.0	9.4	10.4	11.1
Public administration	5.0	6.1	6.7	7.2	7.2	6.5
Other services	10.9	7.8	6.1	4.9	4.4	5.4

	Across Occupations					
	1940	1950	1960	1970	1980	1990
OCCUPATION						
Professionals	11.1	13.1	16.7	19.9	21.1	23.5
Managers	13.1	13.0	12.6	12.8	15.5	19.5
Sales	7.5	8.2	7.8	7.4	6.7	6.8
Clerical	13.5	12.8	13.6	14.6	14.9	13.6
Crafts	15.6	18.3	17.8	16.7	15.8	13.3
Operatives	15.2	15.7	14.2	12.5	10.1	7.4
Transport operatives	5.8	5.1	5.1	4.4	4.2	3.9
Laborers	7.8	6.0	4.4	3.5	3.1	3.1
Domestic	3.3	1.3	1.1	0.5	0.2	0.3
Services	7.3	6.6	6.7	7.6	8.3	8.9

Sources: Numbers for 1940-80 are based on the Public Use Microdata Samples (PUMS). Numbers for 1990 are based on a five-year average of the 1988-92 surveys from the March Current Population Surveys.

Notes: The sample includes men and women with one to forty years of experience who were in the nonagricultural sector and who were not enrolled in school or the military during the survey week. Employment shares are calculated as the fraction of total value-weighted weeks worked.

est declines in employment share among these low-skilled occupations appear to have occurred during the 1940s and the 1950s. In summary, the employment shares of the least and most skilled industries and occupations appear to have followed a long-run trend; however, on the basis of these tables it would be difficult to conclude that there is an observable difference in the pace of demand growth in favor of more skilled workers between the 1940s and the 1980s.

Table 3 gave preliminary indications that demand for skill has been increasing since at least 1940. Chart 2 translates these changes in industry and occupation distributions into demand indexes for men at different percentile points of the wage distribution. The indexes we calculate measure the percentage change in the demand for a particular skill group as the weighted average of percentage changes in employment shares of different industries and occupations, where the weights are the group's initial employment distribution across these industry and occupation categories. (See Katz and Murphy 1992 for a more detailed discussion of these demand indexes.) Intuitively, those groups predominantly located in sectors with overall employment growth will experience a rise in demand for their services, while those groups located in the shrinking sectors will experience a decline in demand.

These demand indexes are "biased" measures to the extent that they understate the demand shift favoring groups with rising relative wages. For example, the rise in the college/high school wage premium during the 1980s would have a dampening effect on the growth of sectors that intensively utilize college graduates. Unless this effect is taken into account, the measured demand shifts will understate the true demand shift in favor of college graduates under constant relative wages. To account for this bias, we make a simplifying assumption that the factor demand curves in each sector have unit own-price elasticities and zero cross-price elasticities. Computationally, this amounts to adjusting the demand indexes calculated as described above by adding the group's percentage price change to its percentage change in share. Chart 2 contrasts the resulting demand change index for the 1980s with the average demand change over the previous four decades. If we compare the highest wage and lowest wage deciles, the results in Chart 2 suggest that the demand growth for skill during the 1980s has proceeded at about the same pace as during prior decades. However, demand for the most skilled workers compared with workers in the middle of the skill distribution was much greater during the 1980s than during prior decades. It appears that the recent rapid growth in inequality is associated with the concentration of labor demand growth among the most highly skilled male workers.

CONCLUSION

In this paper we contrasted changes in wage inequality, employment, and growth in the supply and demand for skills during the 1980s with the changes from earlier decades. We find sharp contrasts in labor market outcomes between the 1980s (and sometimes the 1970s) and earlier decades. In addition, these contrasts all go in the same direction, with relative wages and employment falling for low-wage workers more rapidly during the 1980s than during prior decades. The contrasts in the underlying supply and demand forces are not nearly as sharp, however. The supply-side contrasts seem relatively minor, and the demand-side changes are similar (comparing high- and low-skilled) for the 1980s and earlier decades. The increasing concentration of demand growth among the most skilled workers appears to hold some promise for explaining this contrast.

Chart 2

Changes in Relative Demand by Skill Level
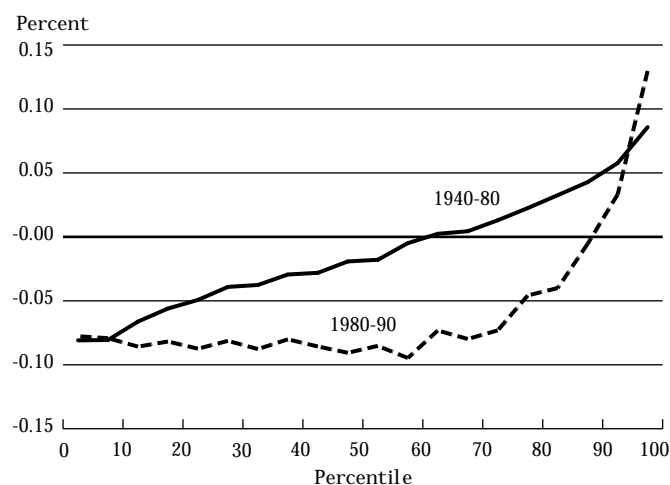
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Morning Session
Summary of Discussion

Thomas Klitgaard and Adam Posen

The morning discussion focused on the causes of the growing wage gap between high-skilled and low-skilled workers. Colloquium participants reexamined the arguments advanced during the morning presentations, questioning some of the speakers' assumptions and terminology. The discussion also drew attention to some sources of wage disparity overlooked by the speakers.

Two nonacademics began the discussion by raising a number of caveats about the papers presented. Ronald Blackwell cautioned that wage stagnation and growing inequality were complex phenomena that could not be attributed to a single cause, be it technological, trade-related, or other. He further observed that dividing workers into high school and college graduates was conceptually different from classifying them as production or nonproduction workers, and that all such categories were overly simplistic measures of skill. In addition, Blackwell commented on the imprecise use of "technological shifts," noting that the term appeared to represent everything that could not be explained by other factors. (Participants expressed concern over loose invocations of technological explanations throughout the session.) Mitchell Fromstein added that academics seeking to explain increasing wage dispersion have not paid sufficient attention to changes in corporate structures and wage-setting institutions. Echo-

ing Blackwell's criticism of equating education with skill, he observed that employers are more likely than in the past to value functional flexibility over specific skills.

Kevin Murphy and George Borjas agreed that the wage dispersion trend prompting discussion is actually a multifaceted phenomenon. Murphy stressed the difficulties in choosing an appropriate base of comparison for the trend. Borjas observed that the debate concerns how much of the trend to allocate to each hypothesis, not which hypothesis is correct; analysts cannot expect to find a single "smoking gun." Barry Bluestone compared the situation to that of Agatha Christie's *Murder on the Orient Express*: the sources of wage inequality, like the culprits in the murder mystery, are many. He noted that the pressures on the top and bottom of the wage distributions are different although the results are evident simultaneously. Advances in technology have tied wages ever more tightly to skill differentials for high-skilled workers, while corporate responses to competition have pushed wages down for low-skilled workers. Larry Mishel followed up on Murphy, emphasizing the difference between growing wage inequality and increasing returns to education. The latter, he noted, explains half the growth in wage dispersion, is not tightly linked to skills or technology, and will become increasingly important in the 1990s.

More than one participant wondered if the height-

ened concern over wage dispersion stemmed from stagnant growth in average real wages. Samuel Brittan attributed flat real wage growth to a growing supply of unskilled workers. Countering this suggestion, Robert Lawrence said that if such a supply-side explanation were correct, we should see a drop in the per capita relative return to labor and a rise in the relative return on capital—an outcome not supported by the evidence. Even if we allow for some error in how we measure capital, the dispersion in wages is still too large to be explained by changes in labor supply, added Murphy.

Gary Burtless drew attention to another dimension of the growing dispersion in U.S. workers' wages: earnings differences among people with the same level of education and occupational skill. Burtless observed that these differences account for more than half of the rise in earnings inequality since the early 1970s and stem in part from increasing transitory variation in earnings, especially among low-wage workers. The increased volatility in earnings is in turn linked to greater variability of hourly wages; workers are now more likely to move back and forth from high-paying jobs to low-paying jobs than in the past.

A number of participants agreed that competitive pressures, especially on deregulated industries, were driving out the higher wages and wage stability traditionally enjoyed by all workers in these industries. The increased competition is now forcing firms to be more selective in rewarding their most productive workers, thereby creating greater wage dispersion within occupations for these particular industries. Richard Clarida thought a potentially positive effect of this development is that the more productive workers in the affected sectors are more likely to earn higher pay.

Herb Washington questioned whether the academic distinction between skilled and unskilled hid a more meaningful distinction between white and black or minority workers. Margaret Hayes agreed, asking whether the term "low-skilled" fully captured the experience of minorities, especially teenagers, who often do not get into the labor market at all. Murphy said the academic evidence does not clearly indicate whether blacks with the same skill or education as whites earned less once employed, but shows unambiguously that blacks are less likely to be employed than whites for a given level of education. In addition, participants cited two other factors that would reinforce any initial wage differential for blacks: Lisa Lynch noted that blacks are less likely to receive on-the-job post-school training from employers, and Barry Bluestone remarked that blacks have suffered disproportionately from the disappearance of traditionally high-paid manufacturing jobs, and the accompanying wage-setting regimes, from the northern urban areas.

The morning discussion closed with a debate on the role of international trade in promoting wage dispersion and increasing returns to skills. Brittan asked whether in a truly integrated world economy, of the kind we are just now beginning to glimpse, wages for textile production in Massachusetts or Georgia could differ from those in Malaysia or south India. Two viewpoints were offered in response. Lawrence argued that even under free trade, wage equalization across countries would not occur without free immigration. That is, the wage floor for American workers in low-skill traded goods industries is not the wage of their counterparts in India or China but the wage of American workers in the nontraded goods and the service sectors. An opposing view, expressed by Leamer, is that international competition can force wage equalization across countries in some cases. If the marginal demand for unskilled labor is coming from labor-intensive manufactures such as apparel, competition with Chinese apparel production inevitably drives down wages. But if the marginal demand for unskilled workers comes from the nontraded goods sector at a time when traded goods manufacturing is concentrated in the more capital-intensive goods, then declining apparel prices mean cheaper goods for consumers but not lower wage rates.

At the end of the morning session, those attending the colloquium were asked to rate the relative importance of the various factors increasing wage dispersion in the United States. On average, the group attributed 60 percent of the increase in dispersion to technological change, 10 percent to international trade, and 30 percent to other factors such as immigration, the low minimum wage, and changes in corporate wage-setting institutions.

The Future Path and Consequences of the U.S. Earnings/Education Gap

Frank Levy*

Local labor markets frequently yield natural experiments—the Mariel Boatlift, for example, or the decision of New Jersey to raise its minimum wage while neighboring states held constant. In the national labor market, natural experiments are harder to come by as one event is contaminated by others. The past and future evolution of the earnings/education gap is a case in point. That gap has evolved concurrently with two other developments:

- A twenty-year long period of slow wage growth followed more recently by a falling growth rate of per capita income.

- A continuing trend in which higher and lower income families have become increasingly concentrated in separate geographic areas.

When these events are taken together, they pose the following dilemma:

- Human capital is becoming an increasingly important determinant of earnings.

- In the U.S. context of locally run schools, growing income stratification by place makes it harder for poor and working class children to acquire large amounts of human capital.

- The natural set of solutions to this problem involves intervention by higher levels of government.

- But stagnant earnings and living standards make persons increasingly suspicious of higher levels of government.

This dilemma makes the future of the education/earnings gap a problematic issue.

I will describe the dilemma by first reviewing the context of stagnant wages and living standards. I will then summarize some of the trends—political and demographic—that economic angst has accelerated. Finally, I

will examine the future path of the education/earnings gap in the short run, where the die is already cast, and in the long run, where the factors discussed in this paper will come into play.

SLOWER GROWTH IN EARNINGS
AND INCOME

For reasons of brevity, the changing rate of return to education has often been described as "the college/high school earnings gap." The term is good verbal short-hand—reporters love it—but it sometimes encourages two incorrect impressions. The first is that college graduates and high school graduates are groups of equal size. They are not. Among men ages 25 to 54, 27 percent have four years of college or more,[1] while 48 percent have a high school diploma or less. This means that the earnings of the "median man" will be closer to those of a high school graduate than to those of a college graduate.

The second incorrect impression is that while high school graduates have done badly, college graduates have done very well in an absolute sense. Among men, some have, but many have not. An extreme case—but not a terribly extreme case—is the college class that turned 30 in early 1972 just before wage stagnation began.[2] These men were hurt two times. They were hurt first because they spent most of their prime earning years in a period of slow wage growth. They were hurt again because they reached their late 40s and early 50s just in time for the white-collar recession and the dis-placement of the middle-aged managers who were "earning their age."[3]

Chart 1 traces median earnings for three sub-groups of the male cohort that turned 30 in 1972: high school graduates, college graduates (with no additional schooling), and the "median man" whose earnings rep-resent the median of all cohort members, regardless of education.[4] The path of median earnings for college graduates contradicts a second media story—that everyone is getting poorer. But earnings growth is only moderate—a total of 17 percent over twenty years, with very little of that growth in the last decade.

Median earnings growth for the high school graduate is significantly slower, falling slightly over twenty years. The median man's earnings grew by a slow 11 percent over twenty years, with most of that growth in the first ten years.

Most studies of real wage trends (including my own) focus on the wage structure by looking at, say, the earnings of 40-year-old men in 1980 and 40-year-old men in 1990. The comparisons provide information about the economy and demography but they say little about life as the individual sees it since they obscure the wage gains that accrue to experience.[5] Chart 1 displays those experi-ence-based wage gains for men now in their late 40s and early 50s. Even the men with a bachelor's degree have not seen big earnings gains over their careers.

Chart 1 has several caveats but none of them are serious. First, the data are for men. Women did moderately better than men over the period.[6] Second, the earnings fig-ures, based on published Census data, exclude taxes. It is unlikely, however, that after-tax income grew faster than pretax income over these years.

Third, the earnings figures exclude the rising pay-ments for employer-provided health insurance. But to understand the mood of the country, it makes little sense to include health care costs as income. If rising income makes a person happier, it is because the person knows she can purchase more now than in the past—that is, she can refer

Chart 1

The Earnings Paths of Men Who Were 30 Years Old in 1972
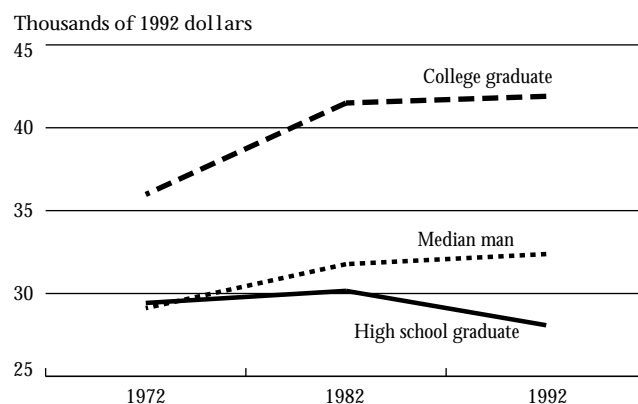
back to her own experience to form a judgment. Better health care means that if a person develops breast cancer today, she has a better prognosis than someone else who had a similar breast cancer fifteen years ago. Persons who are not ill may know all of this in some vague way but not as well as they know that their insurance costs more. Persons who are sick may have difficulty comparing themselves to their counterparts fifteen years ago. In either case, it is unclear that rising health insurance costs should produce the same happiness as an increase in money income.[7]

A final caveat is that earnings are not the whole story—the standard of living as measured by per capita income is important as well. Per capita income continued to rise briskly even after the early 1970s because the composition of the population was shifting toward earners and away from dependents. But that shift had demographic limits and leveled off by the late 1980s. The result is contained in Chart 2, which shows the three-year moving average of the annual growth rate of per capita income. For comparison, the chart also includes a three-year moving average of the annual growth rate of the median income of 35- to 44-year-old men. While the growth of per capita income remains well above the growth of the earnings statistic, both growth rates have been falling over time. In particular, the growth of per capita income has in recent years averaged less than .5 percent a year.[8]

Chart 2

Smoothed Growth Rates of Per Capita Income and Median Income of Men 35 to 44 Years Old
Three-Year Averages
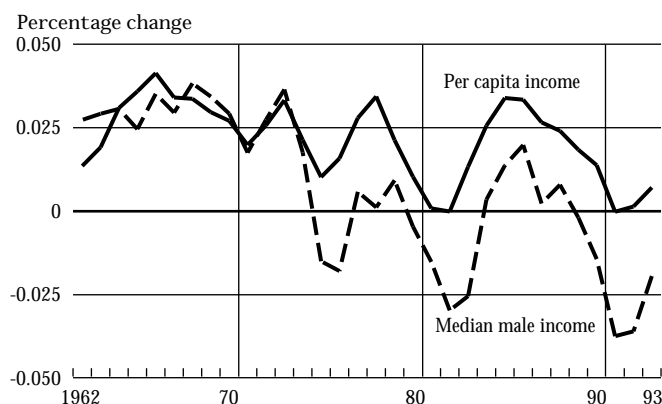
POLITICAL AND DEMOGRAPHIC CONSEQUENCES

In a country that counts on mass upward mobility, slow earnings growth has had obvious consequences. The clearest is real disgust with government—particularly the federal government. The President's approval rating now stands at about 38 percent, and the approval rating for Congress is about half as high. In the current electoral climate, it is fashionable to blame most of this response on President Clinton's policy problems and personality. In reality, the issues are more long-standing. Consider two responses to the Washington Post-ABC News Polls in the fall of 1991, a year before the last election:

Question: When the government in Washington decides to solve a problem, how much confidence do you have that the problem will actually be solved?

A lot	7%
Some	31%
Just a little	38%
None at all	23%
Don't know	1%

Question: Do you think elected leaders in Washington are really interested in solving the nation's biggest problems, or do you think that they are just interested in appearing to solve them?

Only want to appear to solve them	65%
Really interested in solving them	29%
Don't know	1%

So the antipathy toward the federal government has been there for some time. Attitudes toward lower levels of government, while slightly more positive, are still distrustful.

It is likely that economic insecurity and frustration play a role in these attitudes. And as the data in the previous section suggest, economic problems are not limited to high school graduates. For example, political analyst Stan Greenberg has done an extensive examination of the religious right—conservative Protestants who voted in the 1992 election, attend church at least once a week, and identify themselves as evangelical, charismatic, or pentecostal. Greenberg found that the educational attainment of these voters is not heavily skewed toward high school grad-

uates but instead closely resembles the educational attainment in the rest of the electorate.[9]

Turning away from higher level government means, of necessity, turning toward lower levels of government for at least some functions. Here it is important to note a second trend: the growing sorting of neighborhoods by income. At one level, this trend is very old—far older than economic stagnation. It began in earnest at the end of World War II as mass automobile ownership allowed the middle class to leave central cities for suburban single-family homes. But the trend has continued, stimulated, I believe, by the increased importance of access to "good schools" in a child's future earnings.

As late as 1965, central cities had significant numbers of middle class families. Today, one-third of all central city children are poor, and central cities contain 45 percent of all poor children. And stratification goes beyond the city/suburban split. In a recent working paper, Paul A. Jargowsky (1994) shows that neighborhood sorting by income has proceeded steadily for all families over the last twenty years, and has proceeded particularly rapidly over the last ten years for black and Hispanic families.[10]

This growing stratification by income has obvious implications for the distribution of educational quality among the current generation of students. There is, first, the issue of fiscal resources for low-income children. Classroom observers have long been skeptical of claims that New York City spends as much per student as do wealthy suburbs. A recent city report resolved the confusion: one-quarter of the city's school budget goes to special education classes for handicapped students, a burden no suburban school district has. In terms of resources, high-income suburbs, with both richer families and fewer problems, have a clear advantage.

Equally important are the peer group effects of increased stratification. The problem is clearest in lower income schools. Outstanding teachers can make any classroom learn. But as numerous studies document, average teachers are often overwhelmed by hostile student attitudes, so that classes settle into "treaties" in which teachers make few demands in exchange for student compliance. Apprenticeships and other schools-within-schools provide

partial solutions, allowing students who want to learn to segregate themselves from their peers. But the growing stratification of families by income makes all of these problems more difficult.

How the Earnings/Education Gap Will Evolve

Given this background, what is the future path of the college/high school earnings gap? The question is most usefully answered in two parts—the short run, where relevant variables are already in the pipeline, and the long run, where answers are of necessity more speculative.

Chart 3 gives a sense of the short term, based on the college/high school earnings gap for 25- to 34-year-old men. This is the most dramatic of recent wage movements—the one most often cited in the press. As shown in the figure, most of this gap developed between 1980 and 1985. Since 1985, the gap has been relatively stable.

It is reasonable to believe that the gap will remain fairly stable in the near term. On the supply side, the collapse of high school wages in the early 1980s led to a surge in the proportion of high school seniors matriculating to higher education. In the coming years, this outward shift in supply will come to dominate the 25- to 34-year-old age bracket and will, ceteris paribus, hold down college wage rates while it shrinks the current excess supply of high school graduates. On the demand side, it appears that the

Chart 3

Median Earnings of Men 25 to 34 Years Old, by Education
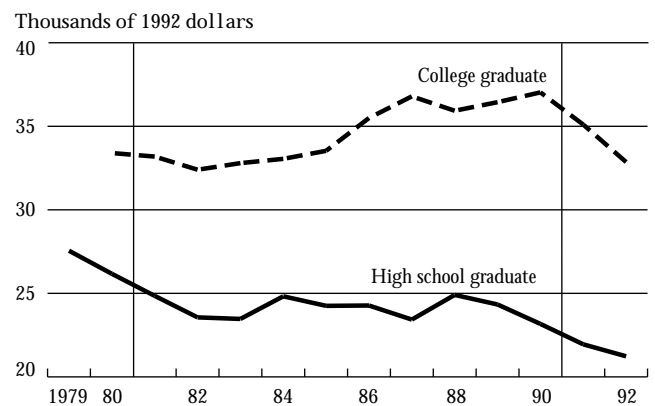
recent white-collar recession is more of a onetime adjustment than a long-term trend. Job creation in the current recovery continues to be concentrated in occupations with high educational requirements, and it appears that both international trade and new technologies such as voice recognition will work against the less skilled. On balance, then, the near term earnings gap seems unlikely to change much in either direction.[11]

In the longer run, however, the prognosis is less certain for the reasons described in the preceding section. If large numbers of children are raised in communities with heavy concentrations of poor and working class families that cannot or will not improve schooling, there are limits to what normal supply responses can accomplish.

This problem, of course, is not an act of nature. It follows from the very decentralized organization of U.S. schools, in which local jurisdictions are responsible for the bulk of educational funding and for setting the bulk of educational standards.[12]

Solutions to this problem come in two forms. One form, alluded to earlier, consists of mechanisms that permit good students in poor districts to segregate themselves. Vouchers and choice are one way of achieving this result. Schools-within-school programs are another. But it is reasonable to believe that all of these programs will leave large numbers of students behind.

A second class of solutions involves intervention by higher levels of government. Legislators could equalize state funding or impose more uniform standards, including the kind of mathematics portfolio assessments being developed in Vermont or wider use of the New York State Regents Examinations. But as I argued above, such solutions become less feasible as economic problems create growing suspicion of government at all levels.

In sum, the college/high school earnings gap indicates that the nation is going through a difficult period, a period in which trade, technological change, and general economic turmoil have created frustrated aspirations. The trick is to keep frustrated aspirations from blocking the institutions that might help us pass through this period to something better.

1. This proportion is actually slightly lower for younger men, ages 25 to 34, in the cohort.

2. My friend Robert Samuelson points out that the sudden stagnation of real wages after 1973 was in part an artifact of President Nixon's wage and price controls. Without those controls, which channeled the recovery into output, stagnation might have begun earlier and proceeded somewhat more gradually.

3. In published data, the median earnings of 45- to 54-year-old men with exactly four years of college fell by about 14 percent between 1988 and 1992. The decline was due in part to a growing cohort size in this age range—the entrance of the baby boom. But much of the decline appears to reflect the downsizing noted in the text. See Levy (1995) for more discussion.

4. In order to use published data, I have approximated the average earnings of 30-year-old men to the published median earnings of men aged 25 to 34; the earnings of 40-year-old men to the published median earnings of men aged 35 to 44, and so forth.

5. Put differently, the term "wage stagnation" usually means that a 30-year-old today earns the same amount as a 30-year-old earned ten years ago; a 40-year-old today earns the same amount as a 40-year-old earned ten years ago, and so forth—that is, the wage structure is stagnating. This stagnation is still compatible with a person's earning more at 40 than at 30.

6. Interpreting published women's earnings in a similar framework is difficult because women's rates of labor force participation changed substantially over the period.

7. Likewise, rising incomes among the elderly may fail to produce political happiness. As with medical care, rising incomes among the elderly typically involve comparisons among different people—the elderly today relative to the elderly ten or twenty years ago. Today's elderly may have little basis for comparing their situations to the elderly of twenty years ago and may make a less happy comparison—that their income is less adequate in retirement than it was in their working years.

8. The weak performance of the earnings statistic partially reflects the 1980s entrance of the baby boomers into this age range. Two other factors leading to discomfort are the increasing rate of job instability (David Marcotte 1994) and the increasing rate of earnings instability (Peter Gottschalk and Robert Moffitt 1994).

9. In unpublished tabulations, Greenberg shows that about 42 percent of the religious right and 37 percent of the rest of the electorate have not gone beyond high school. Thirty percent of the religious right and about 34 percent of the rest of the electorate are college graduates.

10. An example is the way in which black middle and working class families left Washington, D.C., for Prince Georges County, Maryland—a factor partially responsible for rising poverty rates among the D.C. population.

11. At the same time, within-group earnings gaps—for example, earnings gaps among college graduates with different majors—may well continue to grow.

12. At the level of economic theory, this kind of problem has been investigated by Roland Benabou (1992) and Steven Durlauf (1992), among others.

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Trade and Wages: Choosing Among Alternative Explanations

*Jagdish Bhagwati**

The decline in unskilled workers' real wages during the 1980s in the United States and the increase in their unemployment in Europe (due to the comparative inflexibility of European labor markets vis-à-vis those in the United States)[1] have prompted a search for possible explanations. This search has become more acute with the evidence that the adverse trend for the unskilled has not been mitigated during the 1990s to date.

A favored explanation, indeed the haunting fear, of the unions and of many policymakers is that international trade is a principal source of the pressures that translate into wage decline and/or unemployment of the unskilled. As Bhagwati and Dehejia (1994) put it: Is Marx striking again?

I have examined the question of trade explanations at great length in Bhagwati and Dehejia (1994), and the issue has been extensively treated in Bhagwati and Kosters (1994). My conclusion is that the trade explanation is exceptionally weak for the 1980s, that there are good theoretical and empirical reasons why trade did not cause the adverse impact one might fear, and that the case therefore for the overwhelming role of technical change (biased against the use of unskilled labor) in explaining the misfortune of the unskilled is very strong, indirectly and directly as well.

Here, I recapitulate and evaluate the main linkages that have now been advanced between trade and real wages, extending the argumentation beyond that in Bhagwati and Dehejia (1994), originally finished in mid-1993, in light of further research that has emerged since then. l also take the opportunity to speculate about the future instead of confining myself to the 1980s experience and its explanation.

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North-South Trade and the Fall of Unskilled Workers' Wages: A Standard Explanation

Most economists' favorite explanation has been that trade with the unskilled-labor-abundant South (that is, poor countries), as a result of their entry into world markets and the freeing of trade barriers against them, has led to the fall in the real wages of unskilled workers.

This argument requires, in general equilibrium, that the prices of the goods using unskilled labor should have fallen too—as I noted in 1991 when encountering the Borjas-Freeman-Katz paper (1991) asserting that trade was the cause of the decline in real wages without mentioning, leave aside examining, the behavior of goods prices (see the detailed critique in Bhagwati 1991a and 1991b, and subsequently in Bhagwati and Dehejia 1994 and Bhagwati 1994). I conjectured (1991a) that the goods prices had actually gone the other way from that required by the assertion.

The detailed empirical investigation by Lawrence and Slaughter (1993), reported again by Lawrence in his paper for this conference, confirms my conjecture for the United States. The subsequent attempt by Sachs and Schatz (1994) to overturn the Lawrence-Slaughter findings will not hold water. It relies on removing from the data set the prices of computers, a procedure that can be debated. Even then, the new data set yields a coefficient of the required sign that is both extremely small and statistically insignificant. Some newspaper accounts (for example, the recent survey in the *Economist* of North-South issues and a recent *Financial Times* column by Sir Sam Brittan) have reported this "finding" without realizing that, while Noam Chomsky correctly argues that two negatives make a positive in every human language (while two positives do not make a negative in any), the two negatives of a small coefficient, and a statistically insignificant one to boot, do not add up to positive support for the assertion at issue!

Lawrence (this conference and 1994) notes this and also reports that the goods price behavior in Germany and Japan, with and without computers, does not support the trade explanation either. Besides, the shifts in factor ratios also do not support the explanation for the U.S. data.

In short, the necessary empirical evidence for the absolutely critical element in this particular trade explanation is, at worst, absent and, at best, exceptionally weak. The news is not good then for the proponents of the trade explanation along these North-South lines.

Besides, as noted in Bhagwati and Dehejia (1994), even if the goods prices were behaving as required, the conclusion that the result would be a decline in the real wages of unskilled labor requires added assumptions familiar to the students of the Stolper-Samuelson theorem, many of which can be violated without difficulty in the real world. We cite, in particular, a computable-model-based study by Deardorff et al. of Mexico after the North American Free Trade Agreement, which managed to show even a rise in real wages of unskilled labor in the United States by relaxing one particular assumption of the Stolper-Samuelson analysis: the assumption of perfect competition.

Three further comments are in order:

(1) Why have goods prices of labor-intensive goods not fallen during the 1980s? I suspect that in the case of traded goods, at least one major explanation is that the VERs (voluntary export restrictions) on textiles, shoes, and the like, as well as the antidumping actions against several other products that broke out in the early 1980s, may have led to restraints on exports that would translate into a (countervailing) rise in U.S. import prices, and hence in U.S. domestic prices. Ed Leamer has reminded us that the Asian competition in textiles and apparel broke out seriously toward the end of the 1970s, suggesting that the decline in real wages in the 1980s was a lagged response to that. But this explanation will not work: the swift response of the industry to the increased competition from Asia was precisely to tighten the Multi-Fiber Agreement's restrictiveness to offset the potential price fall, leading to the anti-Stolper-Samuelson-explanation price behavior that Lawrence has observed for several countries. The restrictiveness of trade barriers is therefore likely to have increased as required. Such elasticity and also selectivity are in fact characteristics of the "administered" protection as embodied in antidumping actions and VERs and make them both a preferred instrument of protection by industry and also a serious hazard to free trade.

(2) Can we then be sanguine about future prospects for this trade explanation? I believe that we can. Let me explain.

The typical worry is, What happens when China or India comes on board with the trade liberalization that is occurring in many countries? But this concern presupposes that the resulting trade expansion will typically be in the exchange of unskilled-labor-intensive for unskilled-labor-unintensive goods. But there is a great continuum of goods, and considerable trade takes place in differentiated products among "similarly endowed" countries at all levels of per capita income. One could then accommodate huge increases in trade without the prices of unskilled-labor-intensive goods falling.

Just suppose, however, that they will tend to do so. Then there may well be an asymmetry with the 1980s. If the Uruguay Round is ratified, there will now be restraints on VERs—only one will be allowed eventually per contracting party—and the Multi-Fiber Agreement will be phased out in ten years. The ability to offset potential price competition from the South, in the way we did in the 1980s, may no longer be possible.

But even if prices did fall in the end for imported unskilled-labor-intensive goods in the next decade, recall that it is by no means inevitable that this will translate into a fall, rather than a rise, in the real wages of the unskilled in the OECD countries. Bhagwati and Dehejia (1994) have noted several reasons why, as Stolper and Samuelson themselves have observed, all factors of production can gain from the fall in import prices and the associated trade expansion that trade with the South may bring. And these reasons are not at all unrealistic, as I have already indicated. It is, then, simply a fallacy to think that the hand of the Stolper-Samuelson theorem is an iron fist aimed at our unskilled workers.

(3) But whether one is, in my view, an unnecessary pessimist or an optimist on the issue, one policy option follows: we ought to support, not oppose, policy programs to limit the growth of population (and hence unskilled workers) in the South. The optimists will support such programs because they are surely desirable for the large countries such as India and China. This is the considered view of these countries' policymakers, as evident from the Cairo Conference on population this summer. The pessimists should support them in our own interest as well. Let me explain why.

If immigration, which directly brings these aliens into our midst, cannot be totally controlled by us and borders often tend to get beyond control because our political traditions prevent us from shooting at illegal immigrants coming across borders, and if trade is also feared to be simply an indirect way of letting in such alien labor, both phenomena then amounting to pressure on the wages of our unskilled, then the situation is fairly grim. This is especially true if the decline of the ability to redistribute prevents us from compensating the decline in real wages of our unskilled. In that case, we can only hope for lower pressures from the unskilled abroad. This implies our assistance in accelerating their capital accumulation, on the one hand, and in effectively controlling their population growth, on the other.

The shift from the Bush administration's more complacent attitudes on population control, prompted largely by the religious right, to the Clinton administration's energetic support of effective population policies at Cairo, prompted partly by liberal views of women's rights, can then also be explained as a response to the fears of the adverse effect of trade with the South on the real wages of our unskilled.

"KALEIDOSCOPIC" COMPARATIVE ADVANTAGE AND HIGHER LABOR TURNOVER: AN ALTERNATIVE EXPLANATION

Bhagwati and Dehejia suggest an alternative trade explanation for real wage decline. The explanation has essentially four parts:

- Greater internationalization of markets—rising trade-to-GNP ratios, greater role of transnational corporations in globalizing production—together with the diffusion of production know-how (à la Baumol et al.) within OECD countries and the increased integration of world capital markets (à la Jeff Frankel) has narrowed the margin of comparative advantage enjoyed by many industries in any major OECD country. There are, therefore, more footloose indus-

tries now than ever, leading to greater volatility in comparative advantage, that is, more "knife-edge" and hence kaleidoscopic comparative advantage, between countries.

- This will lead to higher labor turnover between industries and hence more frictional unemployment.

- Increased labor turnover could flatten the growth profile of earnings because of less skill accumulation.

- These three factors could also explain the increasing wage differential, ceteris paribus, if skilled workers have greater transferability of workplace-acquired skills than do unskilled workers.

This theory has to be investigated; students of mine at Columbia University are doing this. For example, Eugene Beaulieu is using microeconomic data from the 1988-91 version of the Labor Market Activity Survey in Canada to examine the hypothesis. The survey has a large and rich data base and detailed information on several personal characteristics of workers, which will enable Beaulieu to trace the labor market experience of a sample of workers before and after the Canadian-U.S. Free Trade Agreement. He is also working with alternative measures of comparative advantage and changes therein.

I might add that there is suggestive evidence on elements 3 and 4 of the explanation above in labor studies, as noted in Bhagwati and Dehejia (1994), and also in Lisa Lynch's paper for this conference.

RENTS AND UNIONIZATION

The above arguments are economy-wide trade explanations. But there are industry-specific trade explanations, of course, describing what happens to industries impacted by import competition.

Where these are competitive industries, clearly the earnings of the productive factors within them will be reduced at the outset. When the industry is wiped out, these earnings will go to zero, of course! Nevertheless, the overall final effect on real wages of these factors, including the unskilled, cannot be determined without finding out the general-equilibrium implications of the parametric change, which will take into account, for instance, the absorption of the displaced factors elsewhere in the economy,

which means going back to the economy-wide explanation.

What does the presence of unions, and hence of rents to the unskilled in the unionized sectors, do for our argument? There are indeed models of several kinds of imperfect competition in factor markets in the general-equilibrium analysis of international trade that could be extended to address the question of the overall impact of changing goods prices on real wages, but the answers can be quite unexpected. For example, if unions maintain a wage differential between homogeneous insiders and outsiders, the conventional inferences such as that a fall in the relative price of the unionized sector's good will lead to a fall in its relative production, and therefore presumably a fall in the unionized factor intensively used in it, will not necessarily hold, undermining the Stolper-Samuelson-type argument (inferring factor reward changes from goods price changes).[2] To my knowledge, no analysis of the effects of price declines in unionized industries such as autos satisfactorily addresses these deeper analytical issues that arise when the effects of unions are considered in an appropriate fashion.

Then again, we know that during the 1980s, the unionized sectors in the United States, especially autos and steel, were politically powerful enough to shield themselves greatly through antidumping actions, VERs, and OMAs (orderly marketing agreements) from the effects of foreign competition (which, incidentally, was overwhelmingly from the North, not the South). Given both the small percentage of the U.S. unskilled labor force in unionized manufacturing sectors and the substantial cushioning of competition through trade restraints in any event, it is highly unlikely that the analysts can demonstrate (through this route) a significant role for trade in affecting real wages in the United States during the 1980s.[3]

THE QUESTION OF INTERNATIONAL CAPITAL MOBILITY: GLOBALIZATION AND REAL WAGES

So far, I have considered only the question of a direct link between trade and real wages. But many observers fear that international capital mobility also adversely affects the real wages of the unskilled.

Thus, a major worry of the unions is that the outflow of capital drives down real wages of unskilled workers. However, during the 1980s, more direct foreign investment came into the United States than went out, both during the period and relative to the 1950s and 1960s. Moreover, the United States ran a current account deficit, so that foreign savings came in, if that is the measure one wants to work with instead. The facts are therefore against that hypothesis.

But again, if one uses a bargaining-type of framework, it might be said that the bargaining power of employers has increased vis-à-vis that of employees because employers can increasingly say in a global economy that they will pack up their bags and leave. Therefore, for any given output, its distribution between unskilled-labor income and other income, including profits, may have shifted against unskilled labor.

Perhaps the labor economists at the conference can tell us whether there is persuasive evidence for such a bargaining model as a determinant of relative rewards between factors within any U.S. industry. They might also tell us whether, for such industries, there is evidence that a shift of location elsewhere has altered the distribution against unskilled-labor income.[4] I myself am unaware of any systematic empirical or theoretical work on these questions to date.

At a time when total union membership is down to less than 15 percent of U.S. private employment, however, I doubt if this explanation is likely to be important, unless of course the decline in unionism is itself attributed in a significant measure (as I believe it cannot be) to the loss of bargaining power stemming from firms' threats to exit to other countries.

ENDNOTES

1. Note that this contrast between the United States and Europe is just that, and is supposed to explain only the differential impact of technical change and trade on wages in one country and on unemployment in the other. This labor market explanation is almost a cliché by now, having been propounded by virtually every economist who has spoken on the issue in the last several years. Among the more recent writings on the subject are popular pieces by myself, Krugman, and many others.

2. There is, in fact, a considerable literature on this subject, with contributions by Steve Magee, Murray Kemp, Jagdish Bhagwati,

Note 2 continued

T.N.Srinivasan, Ronald Findlay, and Ronald Jones in the 1970s.

3. For a complementary discussion of rents that cites the broader literature on the subject (including efficiency-wage arguments), see Bhagwati and Dehejia (1994).

4. The threat of exit may exist, of course, even if no exit has actually occurred in the industry.

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Macroeconomic Implications of Shifts in the Relative Demand for Skills

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M y assignment for this conference on U.S. wage trends was, as an outsider, to draw the macroeconomic implications of widening wage inequality. I shall do so in six points.

THE RACE BETWEEN RELATIVE DEMAND AND RELATIVE SUPPLY

The first point is not specifically about macroeconomic implications. It emerges from my reading of the body of research. What has happened is usually described as having come from an increase in relative demand for skills. It is in fact better described as a race, over the last twenty years, between increases in relative demand for skills and increases in relative supply. In the 1970s, relative supply won; in the 1980s, relative demand won. But in both decades, the race has been fast on both sides.

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To make the point more precisely, let me rely on the work of Larry Katz and Kevin Murphy. In Katz and Murphy (1992), they aggregate labor in two groups, high school (H) and college (C), and estimate the following relative demand relation, in inverse form, using data from 1963 to 1987:

$$(1.1) \quad (W_C/W_H) = -0.709\log C/H + \text{constant} + .033 \text{ time}$$

The relative wage depends on the relative supply of C and H—the coefficient implies a fairly high elasticity between the two, $\sigma = 1/.709 = 1.4$—and a time trend, which captures the shift in relative demand. The coefficient on time is the same throughout: contrary to common perceptions, Katz and Murphy find little evidence that the relative demand shift is accelerating.

Now do the following computation. Suppose that there had been no change in relative supply, so that $\log(C/H)$ had remained constant. Then over those twenty-four years, the relative wage of college workers would have increased by .033 times (24) = 79 percent! The actual

increase was only 10 percent. The difference is accounted for by the increase in relative supply. Table 1 builds on Katz and Murphy to show the contribution of shifts in demand and supply to the evolution of the wage.

What is striking is how large the numbers in the first two lines of the table are, how large the shifts in relative demand and supply have consistently been. If one is an optimist, one can read this table as suggesting that it would not take much change in either the rate of change of supply or demand to reestablish balance. If one is a pessimist, one can read it as suggesting that things could easily get much worse, that wage inequality may easily deteriorate faster. But in any case, the message of the table—that both demand and supply have changed rapidly—strikes me as important.

Unemployment

Let me now turn to macro implications. The main macro implication of the increase in net relative demand for skills is likely to be higher aggregate unemployment, or more generally, nonemployment.

The reason is obvious. The labor supply of the unskilled is much more elastic than that of the skilled workers. Thus, the increase in the wage of skilled workers does not increase their labor supply very much, if at all. But the decrease in the wage of unskilled workers can lead to a large decrease in their labor supply.

How large has the effect been so far? The question has been looked at carefully by Chinhui Juhn, Kevin Murphy, and Robert Topel in Juhn et al. (1991). Estimating labor supply elasticities of workers with different levels of wages, they found that they could explain all of the increase in nonemployment of 2.3 percent for prime age males from the early 1970s to the late 1980s (of which 0.7

percent took the form of higher unemployment).

As for what happens in the future, the elasticities at the low end of the wage scale are critical. The elasticities estimated at the low end of the wage scale by Juhn et al. are large by the standards of the labor literature, on the order of .3. These may, however, be quite optimistic. Labor supply depends not only on the real wage, but on the real wage relative to what is provided by the safety net. When the real wage gets close to the safety net, attachment to work is likely to be weak, the elasticity of labor supply likely to be large. My sense is that in the United States at this point, minimum wage or no minimum wage, labor supply is likely to be very elastic at $4 to $5 an hour.

What does this imply? One can use the estimates from Katz and Murphy to do a rough computation. Assume that relative demand is given by (1.1). Now assume that the elasticity of high school labor is given by:

$$(2.1) \qquad \log{(H/\overline{H})} = \alpha \log{(W_H/W_C)},$$

where $\overline{H}$ is the number of H workers and α is the elasticity with respect to the relative wage. Assume that the labor supply of C workers is inelastic, so that all C workers are employed, and $C = \overline{C}$. Finally assume that the number of H workers relative to C workers continues to decrease at the same rate as in the last eight years, so that:

$$(2.2) \qquad \Delta(\overline{H}/\overline{C}) = -2.4 \text{ percent.}$$

Then a few simple steps give:

$$(2.3) \qquad \Delta p(H/\overline{H}) = -1.6\% \frac{\alpha}{1 + 0.709\alpha}.$$

If, for example, the elasticity of supply of H workers is equal to 1—rather than the .3 number used by Juhn et al.—then the annual decrease in the employment rate of H workers is equal to 0.9 percent. Since H workers account for roughly 60 percent of the labor force, this represents a decrease in the employment rate of about 0.5 percent a year, a large number indeed. I believe the basic message of this computation to be right. At the current wages, the labor elasticity of low-skill workers may be quite high. If there is no change in demand and supply trends and no change in policy, we could well see a large decrease in employment rates in the future.

Table 1 RELATIVE DEMAND AND SUPPLY SHIFTS			
	1963-71	1971-79	1979-87
Change in (W_C/W_H)			
Due to increase in demand (estimated)	26.4	26.4	26.4
Due to increase in supply (estimated)	-22.2	-28.9	-18.0
Net (estimated)	4.2	-2.5	8.4
Net (actual)	7.7	-10.4	12.8

The United States versus Europe

The effects of the relative demand shift on nonemployment will obviously be worse if there is a binding minimum wage. But in the United States, the wage at which labor supply becomes extremely elastic cannot be very far from the minimum wage. So, it is not clear that this makes a large macro difference.

The same is not true of Europe, where the minimum wage is a substantially higher percentage of the median wage. But here I want to debunk a theme that is popular in the press and has been endorsed by Paul Krugman (1994). The theme is that the difference between unemployment rates in Europe and the United States comes from different responses to a similar relative demand shift. The United States, the argument goes, has chosen larger wage inequality, avoiding most of the increase in unemployment. Europe instead has limited the increase in wage dispersion, thereby pricing a large number of workers out of the market; the result has been high unemployment.

It is not hard to see why this idea might be popular. The increase in unemployment in Europe has indeed been much larger among the low-skill than among the high-skill workers. Table 2 below, borrowed from Stephen Nickell and Brian Bell (1994, Table 2), shows the basic evolution of unemployment rates in four European countries.

So why doubt the Krugman explanation? I have no doubt that a higher relative minimum wage, combined with the shift of relative demand, has led to more unemployment of the unskilled in Europe. Even that proposition, however, is surprisingly hard to establish from a look at the cross section of European experiences.

But the change in the distribution of unemployment rates in Table 2 is also exactly what we would expect to happen in response to a shift in aggregate rather than relative demand for labor. It is well understood that in response to a neutral adverse shift in demand, various effects—"ladder" effects, "ranking" effects, the labor supply elasticities we discussed earlier—lead the unemployment rate of low-skill workers to increase much more than the unemployment rate for high-skill workers. Back-of-the-envelope computations I have done for a few countries suggest that the evolution of the distribution of rates is roughly what one would expect had the only shock been an aggregate shock and had the elasticities of skill-specific unemployment rates remained the same as in the past. A more careful computation by Nickell and Bell leads them to conclude that only about one-fifth of the increase in unemployment in the United Kingdom is due to the relative demand shift.

Thus, there is a trade-off between unemployment and wage dispersion. But it is not the one shown by a simple comparison of the United States and Europe.

The Shape and Size of Transfers

If one believes—either on income distribution grounds or on grounds of externalities—that something should be done to avoid either the increase in wage dispersion or the increase in unemployment rates for the unskilled, what measures should one advocate?

No economist is likely to be in favor of a substantial increase in the minimum wage as a solution to the shift in relative demand. Most proposals on this and the other side of the Atlantic have focused on employment subsidies for the unskilled. Edmond Malinvaud and Jacques Dreze have argued for the elimination of payroll taxes for low-wage workers. Phelps (1994) has argued for the introduction of a graduated subsidy, phased out at pre-subsidy hourly wages of $10.

How large might these subsidies be? This clearly

Table 2
Evolution of Unemployment Rates
For High- and Low-Education Workers in Four European Countries

		1979-82	1993			1979-82	1991
France	Overall	5.2	9.4	U.K.	Overall	7.7	10.0
	High ed	2.1	5.9		High ed	3.9	5.7
	Low ed	6.5	13.6		Low ed	12.2	17.4
		1979-82	1991			1979-82	1993
Germany	Overall	3.8	5.4	Spain	Overall	11.7	17.9
	High ed	1.6	2.4		High ed	7.9	10.7
	Low ed	4.5	6.2		Low ed	13.5	24.0

Note: Educational levels are defined differently in each country. In France, high ed=two years of university or more; low ed=primary school certificate or less. In Germany, high ed=professional, technical and related, and administrative workers; low ed=production and related workers, transport equipment operators, and laborers. In the United Kingdom, high ed=passed A levels or more; low ed=no qualifications. In Spain, high ed=university; low ed=primary education or less.

depends on the goal, both in terms of wage inequality and of unemployment rates. A simple computation, once again based on the Katz and Murphy relation above, is instructive.

Suppose we wanted to reestablish the wage differential between H and C workers at its level of about ten years ago. Data in Table 1 suggest that this would require an increase of about 15 percent in the wages of H workers. How large a subsidy it would require depends in turn on the elasticities of demand and supply. Take the elasticity of demand from the Katz and Murphy equation earlier. Assume that the supply of C workers is inelastic. Assume that the supply of H workers is a function of the wage differential, with elasticity .2—a number that appears roughly consistent with the average of the Juhn et al. estimates over the relevant range of wages. Then, the subsidy to firms should be equal to 15 percent $(1 + .2 \times .7) = 17$ percent.

How large a subsidy does this represent in terms of the wage bill? From Bound and Johnson, we know that H workers account for roughly 60 percent of employment. Their wage is about 65 percent of the wage of C workers. Thus, a subsidy equal to 15 percent of their wage implies an increase in the wage bill of $(.6 \times .65 \times 1.17 + .4 \times 1)/(.6 \times .65 + .4 \times 1) -1 = 8.3$ percent of the wage bill, or about 4 to 5 percent of GDP.

This is a very large sum indeed. But it is not very different from other estimates. James Heckman has asked a closely related question: How much would have to be spent on training to go back to the 1979 differential? He estimates the cost to be about $160 billion on an annual basis, about 3 percent of GDP. Ned Phelps estimates the cost of his scheme (under the assumption of zero labor supply elasticity) to be around $180 billion. And it only takes care of the widening to date. Under the assumption that the shifts are the same in the future, the cost of maintaining the wage differential increases at a rate of about 0.4/0.5 percent of GDP per year.

Is it likely that anything like this will be put in place? The answer must be no. The political mood is surely not propitious to the creation of new large transfer programs. The main insight from the theory of political econ-omy here is that the earlier such a system is put in place, the more likely it is to have political support. The earlier it is put in place, the more it looks like a social insurance program, the less like a transfer program. But it may already be too late: the winners and the losers are already fairly well identified.

SUPPLY RESPONSES

The increase in net relative demand for skills leads to an increase in the returns to acquiring those skills. Can we expect the effect to be strong enough that increases in relative supply will catch up again with increases in relative demand, leading to little or no further wage dispersion?

The answer from current forecasts, as explained in the paper by Frank Levy for this conference, is indeed for some supply response. The longer run outcome depends on two factors. On the one hand, the return to education has increased; this should certainly lead to a positive supply response. On the other hand, the income of the currently unskilled has decreased. If credit markets are imperfect, so that borrowing against future earnings is difficult, or if primary and secondary education are largely locally financed, this makes it harder for the unskilled, or their children, to acquire education.

Which effect dominates has implications that go far beyond the sign of the supply response: if the sign is negative, wage and skill inequality are likely to be magnified over time. The issues here have been clarified in particular by the work of Roland Benabou (1992). But as far as I know, there is little evidence on the relative strengths of the effects. Whether an increase in wage inequality is likely to lead to more or less education in the United States today is still to be empirically settled.

Even if we do not have the answer, the analysis still has a clear implication. Reducing credit market imperfections to allow people to borrow against future earnings is more desirable than before. There are good theoretical reasons to believe that the government can play a role here, and some good empirical reasons to believe that it can play more of a role than it has played in the past. Moreover, if a transfer program is put in place to reduce wage dispersion, there is an additional argument for avoid-

ing the distortion between unskilled work and education, and thus for subsidizing the college education of poor students.

TECHNOLOGICAL PROGRESS

I see two interesting issues about technological progress in this context. The first is whether, assuming that a good part of the shift in relative demand has come from skill-biased technological progress, this bias will continue in the future. One can think of scenarios in which the future is different from the past. In the paper I mentioned earlier, Paul Krugman indicates that the next step for computers may be to replace skilled workers. He mentions lawyers and accountants. Or, computers may become so user-friendly that workers no longer require computer skills to operate them. The problem here is that, as far as I know, these speculations fairly summarize the state of our knowledge: in short, we do not know.

A slightly more solid reason for believing that the future will be different from the past is based on the fact that technological progress is not exogenous. The shift in relative wages in the last decade has increased the return to developing techniques of production that use relatively more unskilled workers. Here again, we do not know much, if anything. But at least the argument relies on a basic economic mechanism, a response to relative prices.

The second issue of interest is whether the increase in the relative supply of skilled workers—if it indeed happens—will allow firms to adopt new and more sophisticated technologies faster and more effectively, leading them to sustain higher productivity growth. If this were the case, I could end on a rather optimistic note. I could argue that skill-biased technological change may not only lead to an increase in the education of the U.S. labor force, but may also hold the key to higher technological growth in the future.

Unfortunately, there is little evidence to sustain this claim. In this case, we actually have the beginning of an answer from a recent paper by James Kahn and Jon-Soo Lim (1994). Kahn and Lim look at the relation between multifactor productivity (tfp) growth and the share of skilled labor, measured as the proportion of workers with twelve years or more of education. At first glance, their results look quite impressive. Their results imply the following relation across sectors:

$$(6.1) \quad \text{tfp growth} = -6.22\% + 11.25\% \, \beta,$$

where β is the share of skilled labor. The average share is 0.62, so that average tfp growth is .75 percent per year. If the results are seen as implying a causal relation between the share and productivity growth—rather than common factors, or omitted variables—they are quite impressive. They imply, for example, that if the share of skilled labor in the United States was increased from 0.62 to 0.70, tfp growth would increase to 1.65 percent. Unfortunately, however, the results are largely driven by two sectors, tobacco and petroleum, which have low shares of skilled labor and low productivity. Both sectors suffer from notorious measurement problems. Thus, one cannot see the evidence as very conclusive.

SUMMARY

What are the macro implications of the increase in the relative demand for skills? Here are the conclusions of a neophyte:

If the trend increase in the net relative demand for skills continues, it has the potential to lead to substantially higher overall unemployment.

If the trend continues, the size of the transfers needed to offset the increase in wage inequality is much too large to be politically feasible. Subsidies such as cuts in payroll taxes for the unskilled are desirable but will have limited effects.

A positive supply response sufficient to eventually offset the trend in demand cannot be taken for granted. Measures avoiding local finance effects of increased income inequality on primary and secondary education and allowing for easier borrowing by poor students for higher education seem essential.

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The Growing Wage Gap:
Is Training the Answer?

Lisa M. Lynch*

The papers presented in this conference highlight three concerns with current labor market outcomes in the United States—stagnant or declining real wages, stagnant productivity growth, and a widening gap in the wages of skilled and unskilled workers. Several recent examinations (for example, Brauer and Hickok 1994, Freeman 1994, and Lynch 1994) have concluded that one of the solutions to rising wage inequality is to increase the level of training and education of the work force. This paper examines in more detail the potential role and limitations of workplace training in ameliorating the growing gap in earnings across skill groups in the United States, along with its impact on the level of wages and productivity.

In the current debate on the relative importance of trade versus technological change or changing product

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cycles as the primary explanation of the widening wage gap, it is important to observe that many of these factors were also experienced by other countries without a similar increase in the wage gap (for example, see Abraham and Houseman's [1993] analysis of Germany, which shows no increase in wage inequality). This suggests that there are other institutions or factors at play that ameliorate the effect of these factors on the distribution of wages. I would like to argue that training and education systems are one such source. In comparing the incidence of post-school training investments in the United States with the incidence in Germany and Japan, one finds large differences. As shown in the chart on page 55, both Germany (in particular for those aged 20 to 24) and Japan have a higher incidence of firm-provided training than does the United States. This is true even though the incidence measure for the United States is broader than that used for Germany and Japan.[1] As a result of more extensive post-school training for workers with the equivalent of a high school degree, German and Japanese firms treat college-educated

and non-college-educated workers as much closer substitutes in production than U.S. firms. Consequently, when a major technological change occurs that switches the relative demand for skilled workers, German and Japanese workers who are not college graduates are not affected as much as their U.S. counterparts.
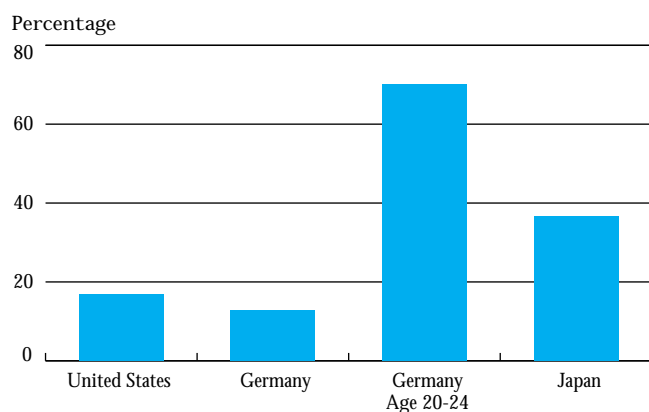
Therefore, training could play an important role in narrowing the wage gap. Training in general increases productivity and, consequently, the wages of workers who experience an increase in their human capital. However, its impact on the relative wages of workers is more ambiguous. In order to narrow the current gap in earnings between skilled and unskilled workers, training would need to be directed disproportionately toward lower skilled workers. At the moment these workers are the least likely in the United States to receive post-school training (see Lynch 1994). The U.S. training system, in contrast to those in Europe and Japan, is highly decentralized and has little formal structure. The possible sources of post-school training include formal and informal employer-provided on-the-job training, off-the-job training obtained in proprietary institutions or in special programs developed in junior or community colleges, government training programs such as the Job Training Partnership Act (JTPA), and the military. One of the key features of the U.S. system is that no national system exists for accrediting vocational skills acquired on the job. Decisions to invest in training

Individuals Receiving Company Training

Sources: *Current Population Survey*, 1991, for the United States; *OECD Employment Outlook*, 1991, for Germany and Japan. Data for Germany and Japan refer to 1989 while data for the United States refer to 1991.

are made by individual workers or specific firms. There is increasing evidence that for the majority of workers in the United States, the training content of most firm-provided on-the-job training is generally task-specific (for example, Lynch 1992) and not geared to preparing workers for a lifetime of skills training as technology and workplace practices change.

As shown in the chart, in 1991 only 16 percent of U.S. workers said they had received formal skills training in their current job, yet recent survey data suggest that nearly half of all establishments in the United States in 1993 provided some type of formal skills training. How can we square the finding that many firms provide training with the fact that few workers seem to get it? Furthermore, what is the impact of this apparent paradox as a possible explanation of the rising wage gap across skill groups in the United States during the 1980s? While it appears that rising skill requirements require firms to provide more workplace training, this training is being concentrated among a small percentage of the work force. As a result, technical and managerial workers are receiving intensive workplace training beyond their already extensive formal schooling, but those workers with the lowest educational levels are the least likely to receive additional firm-provided training. In the United States, highly educated workers are more likely to receive post-school training, placing them in a "virtuous circle" of human capital accumulation. At the same time, high school graduates and dropouts are unlikely to receive additional post-school training, resulting in a vicious circle of low human capital growth. Consequently, given the changes in the workplace that have put an increased premium on skills (changes that have been outlined in other papers in this conference), low-skilled workers find themselves at an increasing disadvantage in the workplace. Both their absolute and relative wages decline vis-à-vis the wages of skilled workers.

What are the returns to training for those who do receive it? Currently in the United States, company-provided training programs, apprenticeships, and off-the-job training seem to increase wages of workers on the order of 4.4 to 11 percent (see Lynch 1994). However, workers in the United States do not seem to gain from previous com-

pany-provided on-the-job training when they move to a new employer. This may suggest that a great deal of company-provided training is relatively firm-specific. In addition, these estimates of the impact of training on wages may be upwardly biased because of self-selection of more "trainable" or motivated workers in workplace training. Therefore, it is equally important to identify and quantify the returns to firms of training investments in the form of productivity gains. Unfortunately, relatively few studies are able to measure the impact of company-provided training on the productivity of workers in the United States. The few studies that do exist (see Lynch 1994 for a summary of these studies) suggest that training increased productivity on the order of 16 to 17 percent. This is a very high rate of return, but until we have a more representative sample of establishments in the United States in which we can control for capital and other characteristics of firms,[2] the returns to training for the typical firm remain somewhat speculative.

Given the apparently high rates of return to workers and firms of training, why isn't everyone receiving training? Firms may not provide training, especially training that workers could use throughout the economy, for a variety of reasons. Smaller firms often have higher training costs per employee than larger firms because they cannot spread the fixed costs of training over a large group of employees. In addition, the loss in total production from having one worker in off-the-job training is probably higher for a small firm than for large firms. This is confirmed in the recent Bureau of Labor Statistics survey of formal training practices of establishments in the United States (1994). More than 50 percent of establishments with 250 or more employees have apprenticeship programs, while only 17 percent of establishments with less than 50 employees have apprenticeship programs. Virtually all large establishments in the survey reported some type of formal job skills training, while only 45 percent of establishments with less than 50 employees had any formal jobs skill training for any employees. Formal skills training in turn appears to consist mainly of three types of skills—management skills, computer skills, and sales and customer relations skills (Bureau of Labor Statistics 1994).

Production workers are not receiving as much skills upgrading as workers in other occupations.

Another reason why firms may not be willing to invest in worker training is high employee turnover. In fact, training itself may contribute to worker turnover: if new skills (such as computer skills, communication skills, or problem solving) are valuable to other employers, the firm risks having the worker hired away. Therefore, firm-specific training that is only useful to a single firm (orientation, specific equipment training) is a more sensible investment for firms than more general training. This would not be a problem if workers could readily borrow money to finance general training themselves, or if employers could pay workers lower wages during general training periods. But workers cannot easily borrow money for workplace training. In addition, since we do not have any system of national accreditation of general skills acquired in the workplace, workers are reluctant to invest (by accepting lower wages during general training periods) even in more general training if the marketplace has difficulty in identifying and paying higher wages for general training that has been provided by a firm.

Firm size and employee turnover can generate alternative strategies within the industrial sector with regard to firm-provided training. Larger firms with better developed internal labor markets can provide more in-house training, while smaller firms must hire workers with skills already in place. This differential corporate strategy could be a partial explanation for some of the rising variance in earnings within groups. However, in order to argue that there is underinvestment in training, we need to believe that there is a market failure in the investment in training in the United States. This failure may take the form of imperfect capital markets that discourage workers from investing in general skills training, or of regulations that raise the costs to firms of providing more general skills training. Alternatively, the failure could be due to scale effects that make training more expensive for smaller firms.

So, without getting bogged down in the percentage of the rising wage gap that is explained by trade, technological change, capital deepening, or shifts in product

demand and product life cycles, what impact could increased training targeted at workers who currently are receiving relatively little training have on wages?

While the impact of trade on the overall wage gap between skilled and unskilled workers may be quite modest, it is clear that trade and increasing international competition have had an impact on the wages of workers in specific sectors such as textiles, apparel, autos, and steel. Increased worker training in these industries should take two forms. First, enhanced skills training to increase labor productivity would allow workers and firms to continue competing in these sectors by using alternative high-value-added production systems and differentiating their production so that they are not competing with low-wage labor from other countries. In the automobile sector this has occurred through a shift to just-in-time production and greater employee involvement in quality control and decision making (à la Saturn). This change requires extensive cross-training of workers in combination with enhanced communication and problem-solving skills. As industries such as steel go for a market niche strategy (for example, mini-mills), workers need to be able to adjust to shorter product runs with much greater variation. Again, this involves increased cross-training. The second form of training would be targeted at displaced workers who have lost their jobs because of technological changes or trade and who need new skills to move to different sectors of the economy. Current government efforts to speed up the identification and development of appropriate training programs for this type of worker should improve the employment and wage prospects of this group.

Since many (but not all economists) seem to focus on technological change as the major source of the widening wage gap, training might play an important role in assisting workers to adjust to technological changes. Revamping the school-to-work transition process to better equip young workers who will not complete a college degree to acquire the skills they need would be useful. The experiences of other countries suggest that effective workplace training programs are characterized by three factors—coinvestment, certification, and codetermina-

tion. Coinvestment increases the commitment of both workers and firms to the training process. Certification enables workers to accept lower wages during training periods because they know that at the end they will be able to document their more general training. Finally, codetermination guarantees that workplace training is not too narrow in content, or too firm-specific.

But addressing the school-to-work transition in the United States does not develop institutional support for those workers already in the work force who find their skills increasingly obsolete. Firms have historically been the only source of human capital accumulation for incumbent workers. Therefore, there is a need to assist firms to develop and expand their training programs, especially for unskilled workers. At the same time, additional support should be provided for incumbent workers who need to return to school.

Let us be clear that training is not some magic elixir that will solve all the problems associated with rising wage inequality, falling real wages for unskilled workers, and stagnant productivity growth in the United States. Training for training's sake will not eliminate the wage gap. Any revision of our training system for new entrants into the labor market would affect relative wages only after a long lag, because new entrants represent a small proportion of the overall work force. At the same time, incumbent worker training, such as that found in Germany, requires substantial financial and institutional support, including a national system of certification and testing (with codetermination of the content of training between employers and workers), government funding of off-site classroom training, and assistance from financial institutions and local chambers of commerce. In conclusion, even if we were able to reform our training system tomorrow for both new entrants and incumbent workers and to reduce the wage gap to its pre-1980s level, the demand for increased training and education would not stop. Since the external forces of international trade and technological change are unlikely to diminish in the future, education and training will continue to be important to maintain and improve living standards and to raise productivity.

Endnotes

1. The U.S. number reflects the percentage of workers who have ever received any training at any time with their current employer, while the numbers for Germany and Japan are the percentage of workers trained in the previous year.

2. Additional evidence on the productivity gains associated with company-provided training programs will be furnished by a new study of more than 3,000 private sector establishments in the United States designed by the National Center on the Educational Quality of the Workforce.

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Afternoon Session
Summary of Discussion

S. Brock Blomberg and Gabriel S.P. de Kock

During the afternoon discussion, the colloquium participants reopened the debate on the sources of rising wage inequality between high- and low-skilled workers. They also considered the potential roles of education and training policies in narrowing the wage gap.

Several participants objected to the assertion that trade and migration influenced U.S. wages. Jagdish Bhagwati argued that if globalization explained wage trends, then increased foreign competition should have driven down prices in certain U.S. industries. For example, prices of U.S. textiles should have fallen as imports from China expanded during the 1980s; however, these prices have remained relatively flat. Robert Lawrence also argued that industries facing increased competition did not experience a fall in prices large enough to explain the drop in wages during the 1980s.

Taking a contrary position, Edward Leamer asserted that prices of apparel and textiles did fall sharply after the first big influx of imports in the 1970s. He stressed that globalization may take years, possibly even decades, to have its full impact on wages. Barry Bluestone echoed Leamer's reasoning, noting that import competition depressed wages in nondurables during the 1970s and slowed the employment growth in durables, particularly electronics, in the 1980s. Bluestone also contended that

import competition influences wages *indirectly*. For example, credible threats to move production overseas depress wages by forcing workers to accept lower wages or risk losing their jobs.

Despite the wide range of opinions, both sides agreed that trade alone could not explain the increased inequality in wages. Other factors cited were declining unionization and the other leading explanation for the wage gap—large-scale technological change. Moreover, all participants agreed that the shift in labor demand toward highly skilled workers—whether prompted by global competition or technological advances—is likely to intensify in coming decades.

In the discussion of education and training as means to arrest the widening wage gap, Lisa Lynch and Suzanne Cutler identified the retraining and continuing education of incumbent workers as the largest obstacle to improving worker productivity. Retraining such a large portion of our work force is extremely costly, they noted, and under existing institutional arrangements, firms have little incentive to provide such training.

Margaret Hayes and Lisa Lynch also discussed problems associated with training first-time workers. They argued that these workers suffer more from a lack of basic problem-solving and communication skills than from a lack of technical skills. According to Lynch, many employ-

ers blame our public school system for not preparing young people. As a remedy, Hayes and Frank Levy suggested that students' performance on standardized academic or skill-based tests be used to evaluate the effectiveness of their schools. However, Hayes and Herb Washington felt that tests are ineffective unless we address some of the deeper socioeconomic problems facing young people: adverse peer pressures, underfunded public schools, and the lure of illegal activities that often provide higher returns than a costly education.

Other participants questioned the magnitude of returns to training and education. Herb Washington noted that workers apparently find little benefit in training since they often fail to take advantage of *existing* opportunities. Samuel Brittan agreed and expressed the fear that government-sponsored training programs will become a politically palatable substitute for income redistribution. Ronald Blackwell argued that only workplace-centered training building on the skills and experience workers already possess is likely to yield large or early returns. At present, he noted, outmoded industrial relations systems and the overly hierarchical organization of U.S. corporations prevent firms from harnessing workers' knowledge. Blackwell recommended that government provide incentives to induce firms to tap this existing knowledge in their training programs.

The panelists then took up the empirical evidence relating education to wages. Olivier Blanchard cited Kevin Murphy's study showing that during the 1980s only the most highly skilled individuals were in great demand as evidence that only advanced training would yield large benefits. Unfortunately, this finding paints a bleak picture for less skilled workers, who have little to gain from sophisticated training. In contrast, Gary Burtless argued that much empirical evidence supports the view that investments in education and training can yield good returns for low-skilled as well as high-skilled workers. George Borjas suggested that selection problems make it almost impossible to eliminate completely the upward bias in estimates of the returns to training: employers, he observed, may choose to enroll only good workers in training programs.

The discussion took a particularly interesting turn when participants considered whether increased income inequality in the United States during the 1980s resulted from the existing labor market structure. A popular argument developed by Paul Krugman blames government policies and institutional structures for our growing income inequality. Krugman asserts that the relative demand for less skilled workers has declined worldwide, so these workers in many countries have had to accept lower wages to keep their jobs. Europe, however, has an institutional structure with rigid labor laws and generous unemployment insurance; thus, employers are unable to cut the pay of less skilled workers and are forced to fire them. Since U.S. wage laws are more flexible, unskilled workers can maintain their jobs by accepting relatively lower wages. The differing institutional structures have therefore led to higher unemployment in Europe and greater income inequality in the United States.

Blanchard challenged this hypothesis, arguing that unemployment in Europe is primarily an aggregate phenomenon. As evidence, he noted that unemployment for *all* types of European workers has increased over the last dozen years, not just for unskilled workers. Consequently, in Blanchard's view, the U.S. wage gap and high European unemployment have little to do with the institutional structures in either country.

Gary Burtless found it unlikely that an adverse shift in aggregate demand could have held down employment in Europe for as long as twelve years. Moreover, he contended that increasing unemployment for European workers at all levels is consistent with Krugman's view because the rigidity of relative wages can hurt the employment prospects of more educated as well as less educated workers. Flexible relative wages in the United States have pushed up wage disparities among college graduates as well as the wage gap between college graduates and high school dropouts. Robert Lawrence also supported Krugman's view, pointing out that overseas employees of U.S. multinationals have had to accept higher unemployment whereas workers employed domestically have had to accept lower wages.

Explaining the Growing Inequality in Wages across Skill Levels

David A. Brauer and Susan Hickok*

During the 1980s, the gap between the earnings of low-skilled and high-skilled workers grew substantially in the United States. Researchers have advanced a number of arguments to explain the increasing disparity. This article uses descriptive and statistical evidence to evaluate two of the most prominent arguments: increased competition from low-wage developing countries—the "trade" argument—and technological advances favoring high-skilled workers. We also consider other proposed explanations of growing wage inequality, although in less detail.

We conclude that technological change, combined with overall growth in the capital stock, is the most important factor driving the growing wage inequality between low-skilled and high-skilled workers. Increased competi-

tion from abroad, both from developing and industrialized countries, appears to explain a significant but much more modest portion of the growing gap. A third substantial source of growth in the wage differential is the shift in demand for the products of different industries.[1]

WAGE TRENDS IN THE 1980S

During the 1980s, there were several striking developments affecting wages in the United States. By at least some measures, real hourly earnings stagnated or declined for most groups of workers, and at best they increased at a far slower rate in this decade than in the 1960s and early 1970s.[2] The stagnation in real wages mostly reflected much slower productivity growth than in earlier decades. Although benefits increased more rapidly than wages, broader compensation measures also showed little or no real growth during the 1980s.

Another significant development of the period, and the focus of this article, is the sharp rise in wage inequality across skill levels. Decomposing earnings data by

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Chart 1

Relative Earnings, by Education Level
Male Year-Round, Full-Time Workers, age 25 to 34
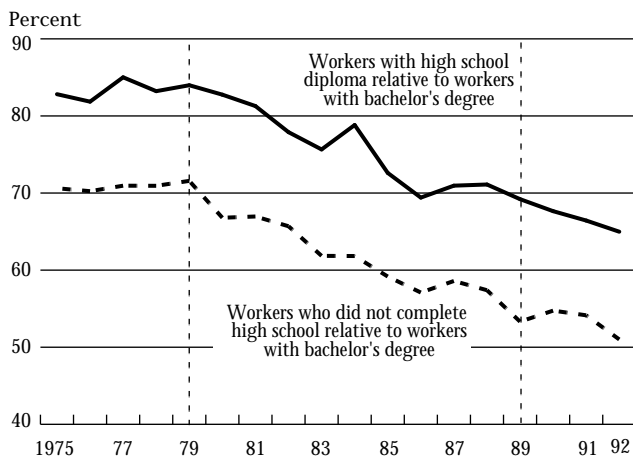
Source: Census Bureau tabulations of data from Current Population Survey.

educational attainment, our primary indicator of skill, shows that for male year-round full-time employees aged 25 to 34, the ratio of annual earnings for those with only a high school diploma relative to those with four years of college fell from 88 percent in 1979 to 68 percent in 1989 (Chart 1). For those with less than twelve years of schooling, the ratio relative to college graduates fell from 72 percent to 54 percent over the same period. Census data show that between 1979 and 1989, median annual wage and salary income for year-round full-time manufacturing workers with at least some college education fell 2.1 percent, while for those with no more than a high school diploma it fell 11.3 percent.[3] A similar pattern is evident within other broad industry categories. Likewise, occupational breakdowns show a rising disparity by skill level: between 1982 and 1989, real white-collar earnings rose 7 percent, while real blue-collar wages fell 2 percent.[4]

PROMINENT EXPLANATIONS FOR THE WAGE GAP

Two explanations for the widening skill differentials of the 1980s have drawn particular attention: international trade and technological improvement.[5] According to the first, cheap imports produced by mostly unskilled workers in less developed countries have depressed the wages of unskilled U.S. workers who produce competing goods. According to the second, technological change has increased the demand for skilled workers relative to the less skilled. The next two subsections discuss each of these arguments in turn, noting what other researchers have to say about each one.

TRADE EFFECTS

Trade theory suggests that imports from developing countries could indeed have worked to depress unskilled U.S. workers' wages. The factor price equalization theorem in its most stringent form predicts that if goods sell for the same price regardless of where they are produced, then workers who produce them will earn equal wages. If, more realistically, we allow nonnegligible transportation costs and production techniques to vary across countries, we would still expect to see a tendency toward equalization of prices and wages as international trade expands. Thus, with increased imports of unskilled-labor-intensive goods from developing countries we would expect to observe downward pressure both on the prices of U.S.-produced goods subject to competition from these imports and on the wages of the (mostly unskilled) U.S. workers who produce them. In fact, as Chart 2 shows, imports from developing countries have increased sharply both in constant dollar terms and as a percent of manufacturing shipments. The

Chart 2

U.S. Manufactured Goods Imports from Developing Countries
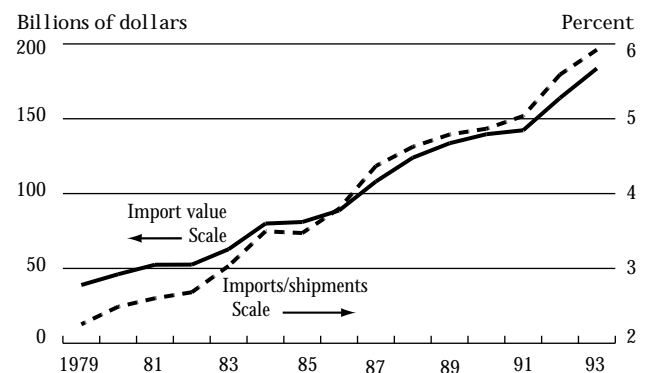
Source: U.S. Department of Commerce.

existence of capital mobility could, by permitting greater equalization of techniques, enhance the tendency of wages to equalize.

Although the theoretical case for factor price equalization is compelling, the verdict on the actual effects of trade on wages has not yet been reached. One major study captures this ambiguity. Katz and Murphy (1992) conclude that increases in import penetration ratios could not explain wage developments during the 1963-87 period as a whole. They do, however, find somewhat stronger trade effects near the end of this period.

Lawrence and Slaughter (1993), who focus on the 1980s, make the strongest case against the trade argument. They contend that prices of low-skill manufactured goods did not fall relative to those of high-skill manufactured goods. Thus, they conclude, international trade could not have put downward pressure either on prices of low-skill goods or on wages of unskilled workers. They also argue that factor price equalization implies a rise in the percent of unskilled workers within industries.[6] This rise did not occur during the 1980s, although, as they point out, other developments may have prevented the rise from occurring.

Krugman and Lawrence (1994) dismiss imports from developing countries as an explanation of 1980s wage trends simply on the grounds that these imports were quantitatively small. Sachs and Shatz (1994) question this reasoning but do not find significant empirical evidence of an effect on wages. They do, however, find that imports from developing countries significantly reduced employment of unskilled production workers. This result suggests that imports may have indirectly depressed the earnings of unskilled workers through displacement into lower paying industries or through crowding effects. Furthermore, Borjas and Ramey (1993) conclude that imports had a significant effect on unskilled workers' earnings in highly concentrated industries such as autos and steel.[7] Their findings primarily involve imports from other industrialized countries, and consequently do not fit easily into the theoretical framework outlined above. These findings do, however, point out the need to examine trade effects in a broader, global context.

TECHNOLOGICAL IMPROVEMENT EFFECTS

Skill-biased technological advances, especially those linked to the computer revolution, may have increased demand for skilled workers by enhancing their productivity. In addition, technological change may have reduced demand for unskilled workers, perhaps because they lack the ability to use technically advanced methods. In support of this view, Bartel and Lichtenberg (1987) have shown that as new technology is adopted, the demand for highly educated workers increases relative to the demand for less educated workers. The authors suggest that the more educated workers' advantage derives from problem-solving ability and receptiveness to change in the working environment rather than from specific skills acquired in school. A simpler explanation holds that computers and other advanced machinery have replaced less skilled workers in the performance of certain tasks.

Most authors who have examined the issue have concluded that the observed changes in the wage structure can be linked to technological change. However, the tests in these studies tend to be indirect or to cover only a particular aspect of technological improvement, and few explicitly address possible trade effects. For instance, Bound and Johnson (1992, 1995) conclude that the relative increase in demand for skilled labor triggered by technological change could explain most of the change in observed skill differentials during the 1980s. They reach this conclusion, however, only by ruling out other possible explanations. Berman, Bound, and Griliches (1994) find that the increase in demand for skilled workers relative to unskilled workers within manufacturing industries during the 1980s could be linked to investment in computers and in research and development. Krueger (1993) demonstrates that workers who used computers earned 10 to 15 percent more than observationally equivalent workers who did not. Because highly educated workers were more likely to work with computers, the growing use of computers alone could account for as much as 40 percent of the increase in the return to education between 1984 and 1989.[8] Both Mincer (1991) and Allen (1993) show a positive link between research and development activity and the relative earnings of college-educated workers.

Thus most of the literature supports the view that technological improvement, or at least some aspect of it, can explain a good part of the widening skill differentials. However, several authors, including Howell (1993) and Mishel and Bernstein (1994), point out that technological advances were by several measures at least as rapid during the 1970s and earlier decades as in the 1980s. Since wage differentials did not begin to widen significantly until the late 1970s, they argue that some other factor or set of factors must have driven the widening in wage differentials by skill level. These articles, however, tend to overlook the presence of supply shifts, which worked to narrow differentials during the 1970s but were less potent in the 1980s.

DESCRIPTIVE EVIDENCE

This section evaluates the trade and technological improvement arguments by examining trends in the U.S. economy during the 1980s. Since each argument implies that the economy should have evolved in specific directions, we can assess its validity by considering how the economy actually developed during the last decade.

As noted above, imports from developing countries surged during the 1980s. If import growth was an important influence on wage differentials by skill level, this surge should have been concentrated in relatively low-skill industries. We would also expect prices of import-competing products in the United States to have declined relative to prices of goods and services not affected by international trade. Following the factor price equalization theorem, we would then expect to see declining relative wages in these industries. As imports gained market share, we would also expect to observe falling employment shares in affected industries.

As for technological change, we noted substantial investment in computers and other sophisticated equipment in the 1980s. If such investments were concentrated in industries employing a large number of skilled workers, and if they in fact enhanced productivity, we would expect productivity to have risen most rapidly in skilled-labor-intensive industries. In the absence of significant demand shifts favoring skilled-labor products, the productivity increase should have reduced prices in these industries rela-

tive to prices in industries using less skilled labor. An increase in productivity should also have led to relative wage increases in high-skill industries, but may have reduced the industries' employment share because fewer workers are needed to produce a given quantity of output.

Table 1 summarizes the implications of the trade and technology arguments. As the table indicates, in each case we must have a catalyst. In addition, because both arguments imply relative price declines in directly affected industries, we need to compare these industries with a control group of industries unaffected by trade or technological change. The technological change argument implies more rapid productivity growth in high-skill industries; the trade argument has no strong direct implications for productivity. In both cases we would expect to see declining employment shares, at least relative to the control group. Most important, within the high-skill industry group we would expect to see a direct correspondence between wage growth and the degree of technological improvement. Within the low-skill industry group we would expect a negative relationship between wage growth and the degree of competition from imports. If workers are mobile across industries, then we might see some of the general trends predicted by the trade and technology arguments, but direct correspondences within each industry group would offer more definitive, "smoking gun" evidence.

To test these implications, we focus on developments in manufacturing between 1979 and 1989. Chart 3 shows changes in the import penetration ratio from devel-

Table 1
IMPLICATIONS OF THE TRADE AND TECHNOLOGY ARGUMENTS

	International Trade	Technological Improvement
Catalyst	Imports surge	High-tech investments increase
Relative price	Down in low-skilled industries	Down in high-skilled industries
Productivity growth	————	Up for high-skilled industries
Employment share	Down for low-skilled industries	Down for high-skilled industries
Relative wage	Down in industry with largest import surge	Up in industry with largest increase in high-tech investment

oping countries, by industry, as a function of industry skill level. We measure skill level as the percent of employees in each industry with at least some college education.[9] We define the import penetration ratio as imports from developing countries divided by total domestic demand (shipments minus exports plus imports from all source countries). The chart shows a substantial surge of imports from developing countries in two of the lowest skill industries—apparel and leather. In other industries we see increases as well, but of a much more modest magnitude. Note that such imports increased significantly in two high-skill industries—machinery and electronics. These increases apparently involved microprocessor production and computer assembly, low-skill segments of what are otherwise high-skill industries. Thus, we see a strong catalyst for the trade hypothesis in two industries and at least a modest one in others.

Chart 4 shows that there was indeed a catalyst for the technological improvement argument as well. Here we plot the change in the net high-tech capital stock per worker, in 1987 dollars, as a function of industry skill level.[10] While technological upgrading was clearly rapid in
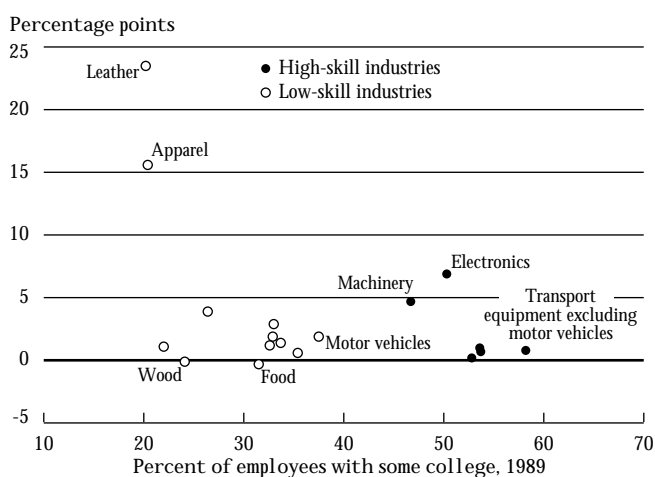
Net High-Tech Investment, by Skill Level 1979-89
Change in Net High-Tech Capital Stock per Worker
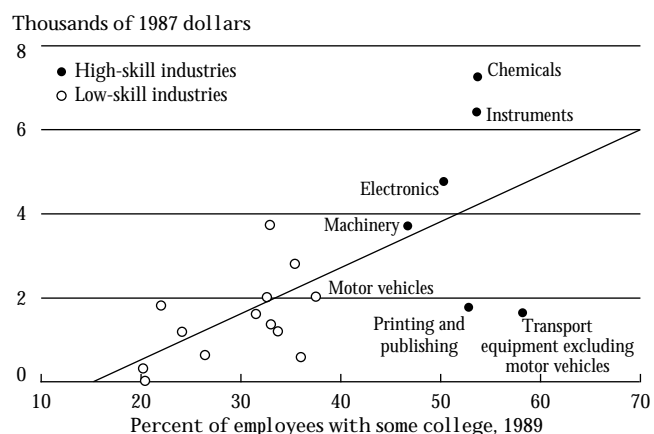
Sources: National Income and Product Accounts for capital stock data; authors' tabulations of 1990 Census data for industry skill level.

Notes: High-tech equipment consists of office machinery, communication equipment, instruments, and photocopy machines. The line represents the estimated regression relationship between industry skill level and high-tech investment. The chart does not show tobacco products and petroleum and coal products.

many industries, the high-skill segment showed much more high-tech investment per worker.[11]

Turning to relative price effects, we examine the path of implicit value-added deflators for three industry categories—high-skill manufacturing, low-skill manufacturing, and all other private industries excluding mining and agriculture (Table 2). As Chart 5 shows, over the decade as a whole, low-skill manufacturing prices did not decline relative to high-skill manufacturing prices, a result consistent with that of Lawrence and Slaughter. However, both high-skill and low-skill manufacturing prices fell relative to the rest of the economy, so we can rule out neither the trade nor the technological explanation on the basis of this test.

The pattern of productivity growth (Chart 6) appears to offer strong support for the technological change argument. Clearly, productivity during the 1980s grew more rapidly in high-skill manufacturing, where technological change was most rapid, than in either low-skill manufacturing or the rest of the economy. Finally, employment shares and absolute levels of both high-skill and low-skill manufacturing declined during the decade (Chart 7).

Imports from Developing Countries, by Industry Skill Level
Change in Import Penetration Ratio, 1979-89

Sources: U.S. Department of Commerce for trade data; authors' tabulations of 1990 Census data for industry skill level.

Note: Chart does not show tobacco products, petroleum and coal products, and miscellaneous manufacturing.
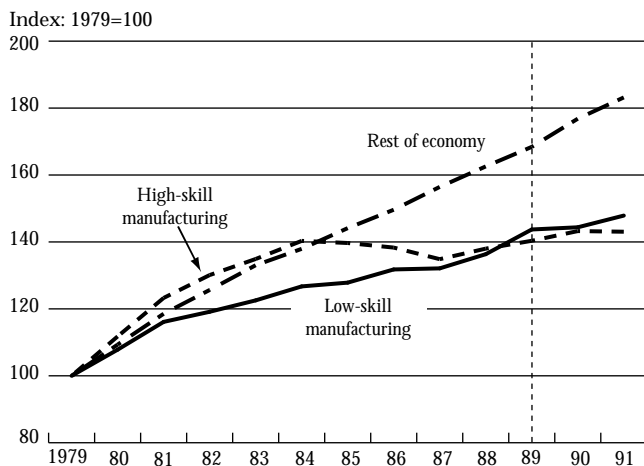
Thus, the evidence presented so far is consistent with the implications of both arguments outlined in Table 1. To complete the analysis, however, we would need to observe a direct one-to-one correspondence between wages and changes in the ratio of import penetration from developing countries, or between wages and our measure of technological improvement. In the top panel of Chart 8 we plot, for low-skill industries, the change in real average hourly earnings between 1979 and 1989 as a function of the change in the import penetration ratio from developing countries. Although apparel and leather showed significant earnings declines, some industries that did not face such a surge (primary metals, food, wood) also experienced large real wage reductions.

Table 2
BREAKDOWN OF MANUFACTURING INDUSTRIES BY SKILL LEVEL

High-Skill	Low-Skill
Industrial machinery and equipment	Lumber and wood products
Electronic and other electric equipment	Furniture and fixtures
Transportation equipment (except motor vehicles)	Rubber and miscellaneous plastic products
Instruments and related products	Stone, clay, and glass products
Printing and publishing	Primary metal industries
Chemicals and allied products	Fabricated metal industries
Petroleum and coal products	Motor vehicles and equipment
	Miscellaneous manufacturing
	Food and kindred products
	Tobacco products
	Textile mill products
	Apparel and other textile products
	Paper and allied products
	Leather and leather products

Chart 6

Productivity, by Industry Category

Source: National Income and Product Accounts.

Notes: Productivity is measured as real output per full-time equivalent employee. "Rest of economy" excludes agriculture, mining, and government.
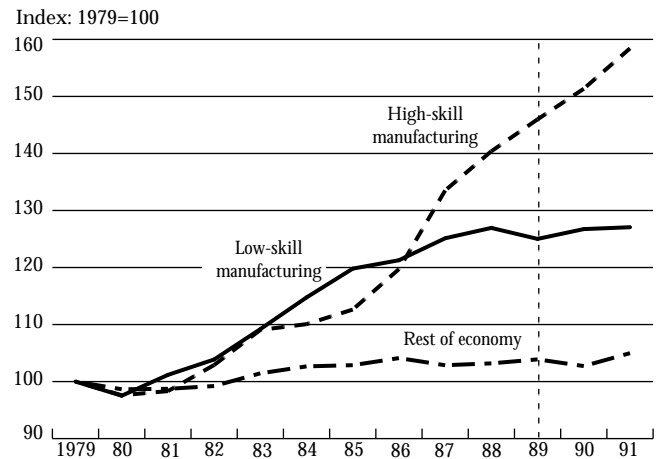
Chart 5

Output Prices, by Industry Category

Source: National Income and Product Accounts.

Notes: Prices are measured using implicit value-added output deflators. "Rest of economy" excludes agriculture, mining, and government.

Chart 7

Manufacturing Employment Shares, by Skill Level
As Percent of Private Nonagricultural Employment

Employment Level (Millions of Employees)	1979	1989
High-skill	8.9	8.9
Low-skill	12.1	10.5
Rest of economy	51.9	70.0
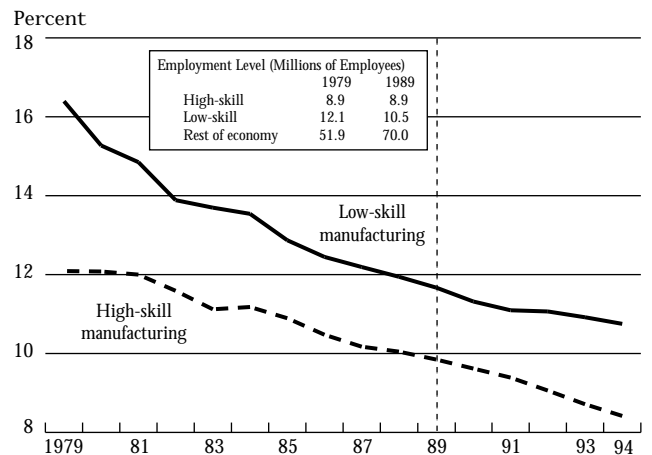
Source: Bureau of Labor Statistics Establishment Survey.

Note: "Rest of economy" excludes agriculture, mining, and government.

One possible reason that apparel and leather did not fare worse is that their import surge translated more into employment losses than into declining wages. Indeed, the bottom panel of Chart 8 shows a somewhat stronger link between imports from developing countries and employment than between imports and wages. Nevertheless, because several industries that did not experience an import surge also showed significant employment declines, the evidence on the effect of imports is inconclusive at this stage.[12]

The evidence supporting the technological change hypothesis is stronger. Chart 9 illustrates, for all industries, the pattern of real compensation growth as a function of our measure of technological change.[13] Clearly, there is a strong positive relationship between the two, with each

Low-Skill Manufacturing: Wages, Employment, and Imports from Developing Countries 1979-89
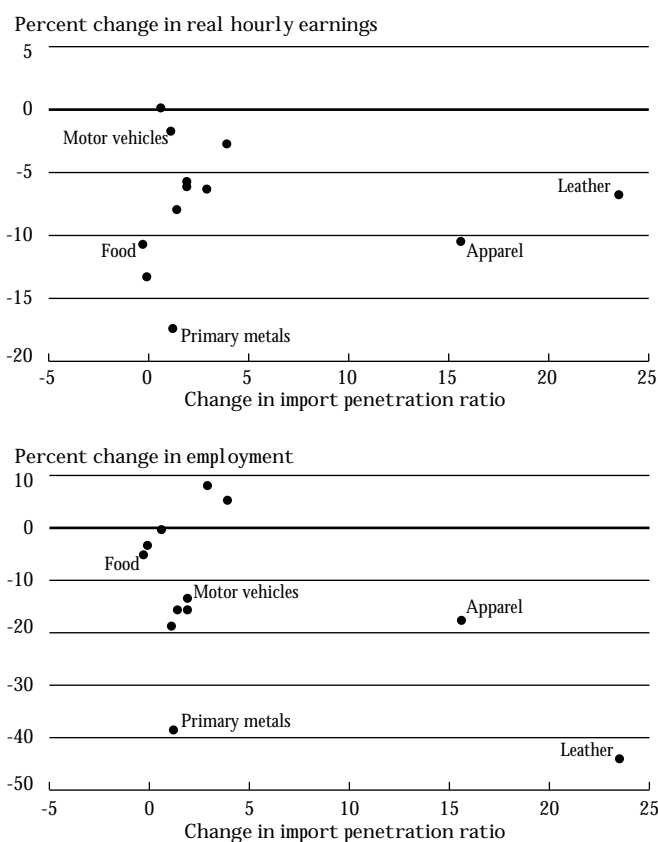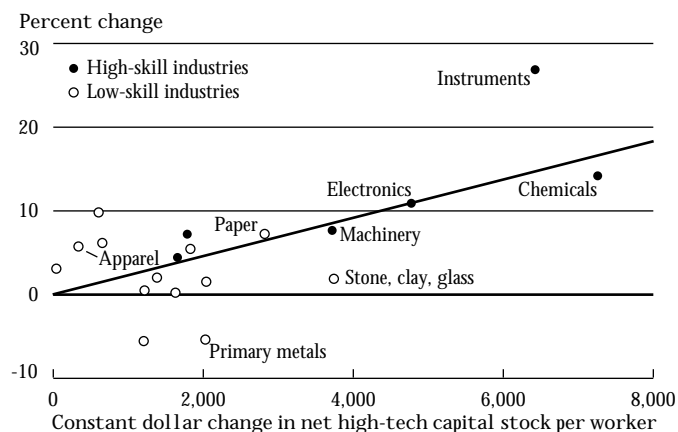

Sources: U.S. Department of Commerce for trade data; Bureau of Labor Statistics Establishment Survey for other data.

Note: Chart does not show tobacco products and miscellaneous manufacturing.

Compensation and High-Tech Investment 1979-89
Real Compensation per Full-Time Equivalent Employee

Source: National Income and Product Accounts.

Notes: High-tech equipment consists of office machinery, communication equipment, instruments, and photocopy machines. The line represents the estimated regression relationship between high-tech investment and compensation growth. The chart does not show tobacco products and petroleum and coal products.

$1000 increase in the high-tech capital stock per worker associated with an increase in compensation of approximately 2.3 percent. This evidence supports the hypothesis that the greater the investment in high-tech equipment in an industry, the greater the increase in productivity, and, especially in the high-skill industries, the greater the rewards for workers.

In sum, although the trade argument passes four out of five of our proposed tests, the direct evidence of an impact on relative wages is ambiguous. By contrast, the technology argument passes all five tests, pointing strongly to the conclusion that technological improvement contributed to the widening earnings disparity by educational attainment.

OTHER PROPOSED EXPLANATIONS

Before applying more formal statistical tests to the trade and technology arguments, we briefly assess other explanations for the observed widening in wage differentials. Katz and Murphy argue that shifts in product demand were fairly important in explaining wage developments between 1963 and 1987. Other researchers, however, have found demand shifts to be relatively unimportant during the

1980s. Most of these researchers measure shifts in demand by changes in employment across industries. This method, however, does not capture the potential impact of demand changes on wages through concessions intended to save jobs.[14] To account for the effect of demand shifts on wages as well as employment levels across industries, we therefore look at changes in an industry's nominal value-added.[15] Chart 10 shows a clear positive relationship between demand growth measured in this way and wage changes. Shifts in demand, consequently, are a possible factor underlying recent wage trends.

A second area worthy of examination, following Borjas and Ramey (1993), is the effect of imports from industrialized countries. These imports are likely to have had their greatest impact in highly concentrated, heavily unionized industries such as automobiles and steel, where U. S. workers had extracted a significant wage premium. Indeed, we have noted that the primary metals industry did experience a sharp decline in wages. As shown in Chart 11, imports from industrialized countries increased significantly during the 1980s. Consequently, we do not rule out increased competition from industrialized countries as another factor driving wage trends.

A further area to investigate is the effect of changes in labor supply on wage developments by skill level. Blackburn, Bloom, and Freeman (1990) find that a substantial portion of the widening in the wage gap by education level during the 1980s stems from a deceleration in the growth of the college-educated work force from the 1970s to the 1980s. Certainly, as young college-educated workers entered the labor force in large numbers during the 1970s while the supply of new workers without any college fell sharply, wage differentials by skill level narrowed. In fact, dramatic changes in the relative supply of labor of different skill levels appear to explain why wage inequality decreased in the 1970s despite large demand shifts favoring skilled workers. During the 1980s the supply of college-educated labor continued to increase relative to less-educated labor, albeit at a much slower pace than during the 1970s. By itself, this development should have led to a further, but less rapid, narrowing in wage differentials across skill levels.[16] Given that these differentials in fact increased, labor supply changes cannot readily explain the wage trends of the 1980s.[17]

Some researchers contend that institutional factors such as declining unionization and the failure to adjust the minimum wage for inflation during the 1980s also played a significant part in widening differentials. Historically, union members received a 15 to 25 percent premium relative to observationally equivalent workers not represented by a union. Many of the beneficiaries of

Chart 10

Demand Growth and Wage Change by Industry 1979-89
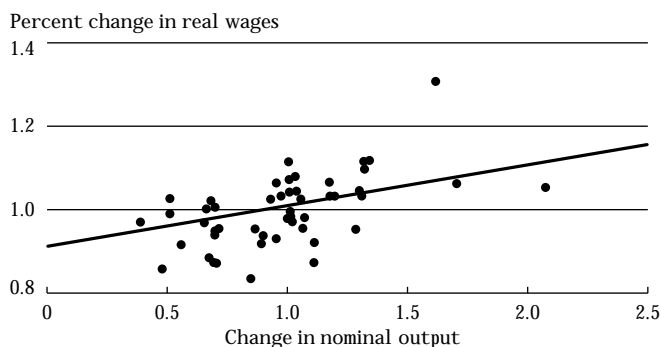
Sources: National Income and Product Accounts; Bureau of Labor Statistics.

Notes: Change in output is percent change in value added, by industry, relative to nominal gross product originating in all private industries. The line represents the estimated regression relationship between demand growth and wage growth.

Chart 11

U.S. Manufactured Goods Imports from Industrialized Countries
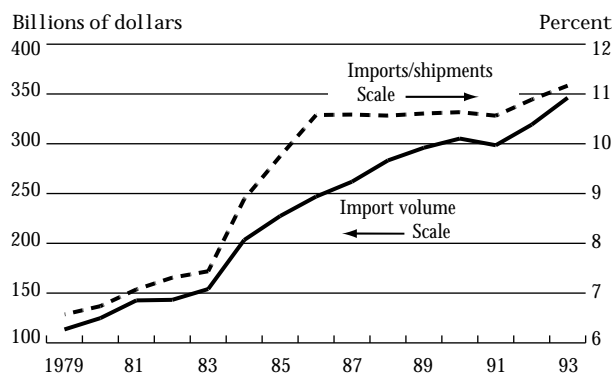
Source: U.S. Department of Commerce.

this premium were men with no more than a high-school education. Blackburn, Bloom, and Freeman (1990) find that falling union density explains about 20 percent of the increase in wage differentials among men during the 1980s. We believe that the decline in unionization during the 1980s at least in part reflects the other factors already discussed, although exogenous political changes may have contributed to the decline. We also believe that the effect of a lower real minimum wage has been limited, largely because few workers are directly affected.[18] Consequently, we do not consider either of these factors in our analysis.[19]

REGRESSION RESULTS

This section supplements the descriptive evidence presented earlier with statistical estimates of the effects of trade, technological change, and other factors on changes in the wage gap between 1979 and 1989. To estimate the long-run impact of structural developments while minimizing cyclical influences, we concentrate on long-term wage changes within industry and educational groupings over the entire ten-year period. Our results are based on reduced-form regressions derived from underlying labor supply and demand relationships across industries and educational attainment levels.[20] That is, each observation in our regressions refers to average wage developments for a given education level within a given industry (such as high school dropouts in the apparel industry).

We have two basic regression specifications. Our first focuses on changes in hourly wage rates for workers with different degrees of educational attainment in different industries. Because this specification ignores the possibility that workers displaced from their jobs by either trade or technological change may be forced to take jobs in lower paying industries, indirectly increasing the wage differential, we estimate a second regression in which the dependent variable is the change in the real wage bill (hourly wage rate times employment) by industry and educational attainment.

In both regressions, we estimate the impact of several industry-specific factors. The first is the percentage point change in an industry's import penetration ratio, calculated separately for developing country imports and industrialized country imports. Other factors are the constant dollar change in an industry's stock of high-tech capital equipment per employee, the percent change in an industry's overall real net stock of equipment (an indicator of newness as well as capital deepening, and thus an alternative measure of technological change), and growth in demand (nominal value-added) for an industry's output. These variables are permitted to have a differential impact on the wages or wage bills of each of four different educational groups—high school dropouts, high school graduates, persons with some college, and college graduates. For our wage bill regression, we also include the economy-wide change in the available supply of labor of each educational group as an explanatory variable because a supply-induced change in employment of any educational group would, all else equal, directly alter the wage bill of that educational group.

Our results show clearly that all of these influences contributed to widening wage differentials by educational attainment. We found a strong positive link between both measures of technological change and increases in the wage *rates* of high-skill workers, and a much weaker connection at lower skill levels. Technological change, moreover, is estimated to have reduced the wage *bill* for all groups except college graduates, suggesting significant displacement of low-skilled workers in some industries. Changes in product demand likewise tended to favor high-skill groups.

Somewhat surprisingly, we found a positive link between import penetration (both from developing and industrialized countries) and skilled workers' wage *rates*, but little effect on less skilled workers. In other words, wages of workers with at least some college education were actually higher, all else equal, in industries that experienced greater increases in import penetration. We found that trade did have the expected negative impact on the wage *bill* at all skill levels, suggesting the presence of displacement effects.[21] Imports from developing countries depressed the wage bill of low-skill workers significantly more than the wage bill of high-skill workers. The negative impact of import penetration from already industrialized countries on the wage bill was somewhat more evenly spread across educational groups.

Table 3 summarizes the contribution of the various factors to the widening wage gap between college graduates and dropouts, and between college graduates and high school graduates, during the 1980s. The figures in the top panel represent the differential impact of each variable on wage rates of college graduates relative to the two other educational groups. As the table suggests, we were able to account for about 35 to 40 percent of the increase in the wage gap. The technological improvement variables were together responsible for more than half of the explained portion of the widening gap. The trade variables accounted for roughly 15 percent of the increase in the gap. Interestingly, increased import penetration from already industrialized countries explained somewhat more of the impact on wage rates than did imports from developing countries. We also found that shifts in product demand across industries accounted for about 30 percent of the explained portion of the gap's widening.

The bottom panel of Table 3 illustrates the contribution of our variables to the differential growth in the wage bill for college graduates relative to both high school dropouts and high school graduates. These results appear to be much stronger.[22] Not surprisingly, much of the difference is attributable to the sharp decline in the proportion of adults who had not attended college, together with the increase in the number of college graduates during the 1980s. These labor supply changes alone would directly reduce the aggregate wage bill for those who had not attended college while raising the aggregate wage bill for college graduates. Our wage bill regression results, however, suggest that our earlier explanatory factors—technological change, import penetration, and demand shifts—also played an important role in the widening wage bill gap. Encouragingly, our results for the wage bill are qualitatively similar to those in the wage rate regression. That is, after abstracting from labor supply changes, technological change combined with growth in the capital stock explains roughly half of the widening wage bill differential. Import penetration accounts for a little over 10 percent, while industry demand shifts explain roughly one-third of this differential's growth.

Table 3
EXPLAINING WIDENING DIFFERENTIALS, 1979-89

	College Graduates versus Dropouts			College Graduates versus High School Graduates		
	Predicted Growth in Gap (Percentage Points)	Percentage of Total Gap	Percentage of Explained Portion of Gap	Predicted Growth in Gap (Percentage Points)	Percentage of Total Gap	Percentage of Explained Portion of Gap
HOURLY WAGE RATES						
Actual	16.9	100		13.3	100	
Explained	6.6	39	100	4.7	35	100
Technology + capital	4.0	24	60	2.5	18	53
Imports	0.8	5	12	0.8	6	17
Demand	1.8	11	28	1.4	11	30
WAGE BILL						
Actual	90.0	100		65.0	100	
Explained	75.0	83		56.1	86	
Change in supply	50.1	56		36.2	56	
Other factors	24.9	28	100	19.9	31	100
Technology + capital	12.2	14	49	9.3	14	47
Imports	2.7	3	11	3.0	5	15
Demand	10.0	11	40	7.7	12	39

Note: Values are based on regressions in Brauer and Hickok (1994).

How have the wages of different skill groups evolved in recent years? Our answer must be tentative since we cannot yet observe wage patterns over an entire business cycle or distinguish structural from cyclical changes. Nonetheless, our examination of the limited available information suggests that many of the trends observed during the 1980s have continued into the 1990s.

Between 1989 and 1993 the median real annual earnings of male year-round full-time workers declined 4.0 percent.* Our examination of data for 1992 from the March 1993 Current Population Survey, summarized in the table, reveals no significant change in the earnings premium of college graduates relative to high school graduates, but a substantial absolute and relative deterioration in the position of high school dropouts. Bound and Johnson's (1995) preliminary analysis of 1993 data, however, indicates that the gap between college-educated and high-school-educated workers continued to widen between 1988 and 1993, though at a slower pace than during the previous decade.

An inspection of wage developments by industry shows substantial real wage declines between 1989 and 1992 in a number of low-skill industries, including wholesale and retail trade, lodging and personal services, and food, but also in some high-skill industries. In general, however, high-skill industries tended to show smaller losses than did low-skill industries. Within manufacturing, average hourly wages fell 2.4 percent in high-skill industries, compared with 6.1 percent in low-skill industries (and 6.2 percent in all other industries excluding agriculture and public administration).[†] Nonetheless, high-skill manufacturing industries suffered greater employment losses than did low-skill manufacturing industries.

The relationship of these facts to the technological improvement and trade arguments is complicated both by cyclical effects and by the impact of defense-related cutbacks. Not surprisingly, many of the employment losses occurred in traditionally cyclical industries. Meanwhile, two high-skill industries with a substantial defense-related component—electrical equipment and transportation equipment other than motor vehicles—experienced 15 percent employment declines. Still, high-skill, technology-intensive industries not subject to either of these influences (for example, computers, chemicals, and communications) tended to perform fairly well, and technological improvement continued at a rapid pace.

Trade developments are harder to judge. In general, with the exception of leather and apparel, the rates of import penetration from all countries showed little further increase from 1989 levels. But because most import-sensitive industries tend to be cyclical, it is difficult to draw wage and employment implications from these trade developments.

WAGES AND EMPLOYMENT
By Education Level, 1989-92

Education Level	Percent Change in Real Hourly Earnings	Employment Share 1989	Employment Share 1992
High school dropout	-15.9	18.2	14.3
High school graduate	-6.4	31.1	34.2
Some college, less than bachelor's degree	-6.8	29.7	28.2
Bachelor's or higher degree	-6.9	20.9	23.4
Total	-5.8		

Sources: 1990 Census Public Use Microdata Set; March 1993 Current Population Survey. Sample consists of wage and salary workers who worked at least 200 hours. Earnings are deflated using the consumer price index.

*U.S. Department of Commerce, Bureau of the Census. "Income, Poverty, and Valuation of Noncash Benefits: 1993." Current Population Reports, Series P60-188.

[†]These figures are based on our tabulations of data from the March 1993 Current Population Survey for 1992 and the 1990 Census Public Use Microdata Set for 1989.

CONCLUSION

Our analysis suggests that technological progress, combined with an increase in the capital stock, was the most important demand-side influence on the growing inequality between the earnings of low-skill workers and high-skill workers. International trade was also a significant, albeit relatively modest, factor. Trade with industrialized countries contributed as much to the growing wage gap as did trade with developing countries, contrary to the assumptions of the most commonly expressed trade argument. Shifts in demand for the output of different industries surpassed trade in importance but fell short of technological progress as a cause of the growing wage gap.

We may take some encouragement from these results, since technology and capital deepening raise economy-wide output and, hence, economy-wide welfare. Nevertheless, all workers must be able to share in the economy's gain. A good case can be made for policy initiatives that focus on education and training.[23] Efforts should be made at every education level to enhance the ability of all laborers to work with technologically advanced equipment. Moreover, we need to consider seriously what worker attributes will be valued in an economy where routine tasks are increasingly carried out by sophisticated machines. Only then can we take the necessary steps to foster these attributes, again across education levels.

ENDNOTES

1. Note that in this study we concentrate on developments affecting the demand for labor of different skill levels. During the 1980s the supply of unskilled labor declined relative to that of skilled labor. By itself, this development should have operated to narrow wage differentials by skill level. Blackburn, Bloom, and Freeman (1990) note that the supply of skilled labor grew even more rapidly in the 1970s than in the 1980s, while actual wage differentials narrowed. They argue that one major difference between the two decades was the weakening of these supply factors.

2. For a discussion of measurement issues, see Bosworth and Perry (1994).

3. In this article, unless noted, we construct real wage measures using the CPI-U-X, a variant of the consumer price index that is based on a historically consistent treatment of homeownership costs.

4. These figures are based on the employment cost index. Data by occupational category are only available since 1982.

5. For a comprehensive survey of the literature, see Levy and Murnane (1992).

6. The reason is that the resulting increase in the relative wages of skilled workers would, in the absence of skill-biased technological change, induce employers to economize on skilled labor.

7. This argument is summarized in Borjas (1995).

8. It is possible that workers who are "better" in ways not captured by observable measures of skill, and consequently better paid, are more likely than "inferior" workers to use computers.

9. This variable was calculated from the 1990 Census Public Use Microdata Set. Although average educational attainment tended to rise within all industries during the 1980s, the industries' relative positions on the skill spectrum would have been essentially the same had we used data from the beginning of the decade.

10. We chose the dollar change rather than the percent change because an increase from twenty-five to fifty computers per hundred employees would have far greater impact than an increase from one to two per hundred, even though in percentage terms these are equivalent.

11. We cannot rule out reverse causation: wage increases within an industry could stimulate investment by lowering the cost of capital relative to labor. Still, productivity-enhancing investment would be expected to result in higher wages.

12. Even if we could demonstrate that trade was important, we might not observe a stronger link between import penetration and declining wages and/or employment. A clearer link might emerge only at a more disaggregated level of analysis. In addition, an import surge could have depressed unskilled workers' wages not only in directly affected industries, but also in other industries as workers displaced from an affected industry sought employment elsewhere. Third, the industries most affected by the import surge from developing countries were already paying low wages, so they may have been unable to cut wages much further. In 1989 the average wage in apparel on a year-round, full-time basis would have provided barely enough income for a family of four to reach the poverty line. A fourth possibility is that part of the effect was masked because the relatively high value-added segments of an industry were most likely to survive an import surge. Finally, special factors such as corporate restructuring or demand shifts could have explained developments in the other low-skill industries that fared poorly.

13. We use compensation here because of data limitations affecting average hourly earnings measures for electronics and instruments.

14. Bluestone makes this point in comments accompanying Blackburn, Bloom, and Freeman (1990).

15. Changes in nominal value-added could pick up some supply shifts as well as demand shifts.

16. See Blanchard (1995).

17. As Borjas (1995) observes, one particular aspect of supply that may have been important was immigration.

18. For a contrasting view, see DiNardo, Fortin, and Lemieux (1994).

19. Another argument, expressed in Bishop (1991), is that the declining quality of less-educated workers, as evidenced by falling SAT scores, could account for part of the widening of wage differentials. This view is criticized by Freeman and Katz (1994), who point out that during the 1980s wage differentials by level of education rose within all age groups, including those who attended school well before the alleged deterioration in quality took place.

20. Full details of the regression specification, data sources and definitions, and results are in Brauer and Hickok (1994).

21. This displacement effect probably explains the positive link between import penetration and skilled workers' wage rates. Import penetration likely displaced the weaker, lower paid segment of the affected

Note 21 continued

industries, raising the reported average wage rate within those industries.

22. Once we eliminate the impact of changes in labor supply, our other variables explain about two-thirds of the widening of wage bill differentials between college graduates and high school dropouts or high

Note 22 continued

school graduates. The unexplained residuals account for the other third. In contrast, these same nonsupply variables only explain about one-third of the widening in the wage rate differentials, with unexplained residuals accounting for two-thirds of the growing gap.

23. See Lynch (1995).

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Errata

The date on the spine of the summer-fall 1994 issue of the *Quarterly Review* was incorrectly given as "Winter 1993-94." In addition, the issue number, on both the cover and the spine, should have been "2-3."

We apologize for the errors.