

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

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**D**uring 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.<sup>1</sup> 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.<sup>2</sup>

### 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  $\mu_{so}$  and the  $\lambda_i$ '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  $\lambda_{do} = .8$   $\lambda_{so} = \mu_{so} = .50$ .<sup>3</sup>

*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
<b>MEN</b>							
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
<b>WOMEN</b>							
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  $1/1.5$ )  $\times .042 - .029 = .0087$ .<sup>4</sup>

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.<sup>5</sup> 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.<sup>6</sup>

**Table 2**  
ESTIMATED DETERMINANTS OF LOGARITHMIC CHANGE IN RELATIVE MEDIAN EARNINGS

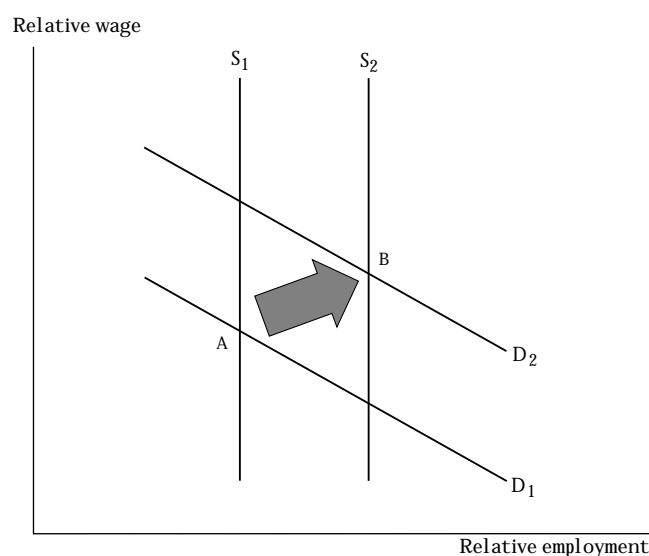
	1979-88			1988-93		
	(1)	(2)	(3)	(4)	(5)	(6)
Proportion college	.304 (.039)	-	.314 (.058)	.101 (.018)		.084 (.028)
White collar	-	.099 (.021)	-.006 (.026)	-	.036 (.009)	.005 (.013)
Women	.119 (.021)	.118 (.026)	.119 (.021)	.042 (.010)	.042 (.011)	.042 (.010)
Intercept	.256 (.012)	.269 (.016)	.257 (.013)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

## 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



**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,<sup>7</sup> 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).<sup>8</sup>

#### 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-

ties.) The change most commonly cited as a cause is the decline in union representation in the United States.<sup>9</sup> 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.<sup>10</sup>

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.<sup>11</sup> The qualitative effects of a fall in union representation, such as occurred at an accelerating rate in the 1980s, are similarly unclear.<sup>12</sup>

#### 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.<sup>13</sup>

The obvious problem with this view is that the

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

Group	Employment Proportion		Rent	
	1973	1988	1973	1988
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.

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.<sup>14</sup> 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,<sup>15</sup> 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.

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## ENDNOTES

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  $w_i$ ,  $w_{ni}$ , and  $w_{ui}$  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,  $w_1$  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

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## ENDNOTES (*Continued*)

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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