Earnings in the 1980's: an occupational perspective

The earnings gap between more and less educated workers increased during the 1980's; changes in occupational demand accounted for roughly a third of the increase

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The 1980's were a decade of dramatic change for the earnings structure in the United States. Differentials in earnings by education widened considerably, the average pay of older workers increased relative to that of younger workers, and the earnings gap between men and women narrowed markedly. By some measures, these and other changes in the wage structure caused overall levels of earnings inequality to rise to heights not previously seen in the post-World War II period.[1]

Much research conducted in an attempt to document and explain the recent changes had focused almost exclusively on the demographic characteristics of workers.[2] A great deal has thus been learned about which groups have made relative gains, and which have lost, in the labor market. Unfortunately, much less is known about what kinds of jobs these different workers hold, how their distribution among jobs has changed over time, and what the trends imply about the match between skills being demanded by employers and those available in the work force.[3]

Explanations for the changes in the earnings structure can be classified into three categories: changes in the supply of labor of different types, changes in the demand for this labor, and changes in wage-setting institutions. The analysis set forth in this article fits best under the second category, as it assesses changes in the demand for skills in the workplace.

Directly measuring trends in the market for skills is obviously a formidable task. Accordingly, the analysis takes the approach that substantial insights into this issue can be gained by focusing on occupations as indicators of the skills being demanded in the workplace. Given that each occupation differs in terms of the bundle of skills it requires, focusing on recent developments concerning the distribution of employment across occupations and concerning earnings by occupation (which can be thought of as a return to the bundle of skills utilized on the job) will give a better understanding of the changing market for skills. In part because demographic groups differ in the skills they have acquired, they will differ in how they are distributed across occupations and thus in the impact changes in occupational demand will have on their earnings.[4] The article assesses how much trends in the skills market—looked at through the proxy of occupations—have influenced the aforementioned earnings trends. Or, put in the form of a question, Were those groups that gained ground in the 1980's able to do so because the skills they possessed—as evidenced by the occupations they were concentrated in—were in growing demand?

Changes in relative earnings

The relative earnings trends that are at the focus of the analysis presented in this article are shown in table 1.[5] The calculations use the March Current Population Surveys (CPS) for 1974, 1980, and 1990, which contain data on earnings for the preceding year.[6] The shifts between 1979 and 1989 are the primary focus, with the data for 1973–79 providing a context for comparing the 1970's with the 1980's and with the data for 1973–89 showing how demographic groups fared in the entire period since real wage growth began to stagnate in the mid-1970's.

A number of important trends are apparent from the earnings changes shown in the table for

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full-time, year-round workers. Most striking is the performance of men who did not graduate from high school. In real terms, their earnings declined by nearly 20 percent between 1979 and 1989, and by nearly 25 percent relative to college graduates.[7] For women, there is a similar widening of the gap between the more and less educated, although in absolute terms, only those who did not graduate from high school suffered a decline in purchasing power. The gains by more educated groups are in sharp contrast to trends in the 1970's, when, on the whole, these groups *lost* ground. Also of note is that there has generally been an increase in returns to experience[8] for men. To give the most dramatic example, between 1973 and 1989, earnings of men with 30 or more years of experience rose by 14.5 percent (0.034 – (–0.111) = 0.145) relative to those with 10–19 years of experience.[9] Finally, women have gained substantial ground on men in recent years—12.3 percent between 1979 and 1989 alone.

Table 1. **Changes in real earnings of full-time, year-round workers, 1973–89**

[Difference in averages of logarithms]

Demographic group	1973–89	1973–79	1979–89
All	–0.023	–0.019	–0.004
Men	–.050	–.018	–.032
Women	.137	.047	.091
Years of schooling			
Men:			
0–11	–.247	–.051	–.196
12	–.155	–.041	–.113
13–15	–.071	–.044	–.028
16 or more	–.024	–.073	.049
Women:			
0–11	–.018	.041	–.059
12	.042	.028	.015
13–15	.076	.005	.071
16 or more	.122	–.019	.141
Years of potential experience[1]			
Men:			
0–9	–.082	–.002	–.080
10–19	–.111	–.026	–.085
20–29	–.049	–.033	–.016
30 or more	.034	.029	.005
Women:			
0–9	.107	.055	.051
10–19	.135	.042	.093
20–29	.157	.033	.125
30 or more	.095	.043	.051

[1] Potential labor market experience is defined as age, minus number of years of schooling, minus 6 years, to account for the preschool period. It is used because the Current Population Survey does not measure *actual* labor market experience.

NOTE: Earnings are deflated into 1989 dollars using the gross domestic product deflator for personal consumption expenditures.

Explanations of the changes

Why did these profound changes in the earnings structure occur in the 1980's? As noted earlier, alternative hypotheses can be grouped into three categories: changes in the supply of labor of different types, changes in the demand for this labor, and changes in institutions that affect the setting of wages.

The supply of workers. Economic theory tells us that an increase in the relative supply of a demographic group tends to depress that group's earning power. To give a prominent example, supply-side changes resulting from the entry into the work force of the baby-boomers was an important factor in the rise in returns to experience during the 1970's.[10] An examination of supply patterns, however, reveals little support for simple supply-side explanations for the changes in the 1980's. The calculation of relative supply indexes (a measure of the share of jobs held by specific demographic groups), shown in table 2, demonstrates a striking increase in the average education level of the labor force.[11] For both men and women, college graduates were the fastest growing education group in the 1980's, with those without any college at all showing declines as a share of the labor force. Yet, this is exactly the opposite of what a supply-side explanation would predict. Indeed, the data show that those education groups with the fastest growth in earnings had the biggest rise in their share of the labor force. Similarly, women posted gains in their share of the labor force at the same time their earnings were moving closer to men's levels. With regard to potential experience, the picture is somewhat less clear. It suffices to say, however, that there is no obvious pattern indicating that the groups with the largest increases in earnings have declined in their relative shares of the labor force.

With a simple supply-side explanation ruled out, it is worthwhile to consider more sophisticated supply-side hypotheses for the rise in returns to education. Some observers have speculated that a decline in the quality of high school education, perhaps coinciding with a decline in test scores that occurred during the 1970's, may have contributed to a widening gap between the productivity and, thus, the earnings of those who have gone on to college and those who have not. This hypothesis is inconsistent, however, with the fact that education-earnings differentials widened for cohorts that entered the labor force well before the postulated decline in the quality of high school education. Past research has found some support, however, for the idea that the position of the less educated—particularly those without a high school education—has worsened owing to the increase in the relative supply of less skilled labor resulting from a rise in the flow of immigrants into the labor force.[12]

June O'Neill and Solomon Polachek explore a supply-side hypothesis for the gains in earnings of women relative to men.[13] They find that much of the contraction in the gap can be explained by forces relating to actual labor market experience: first, differences in actual labor market experience have narrowed, and second, differences in returns to this experience across the genders have narrowed, which they attribute to higher levels of on-the-job training for women.

The demand for workers. Perhaps the most prominent hypothesis on the demand side has been that shifts in the industrial composition of employment—particularly as a result of the decline in the employment share of manufacturing—have reduced the number of high-paying jobs available to workers with low levels of education. Recent research[14] provides some support for this hypothesis in connection with the widening of education-earnings differentials, but overall, most of the increase in returns to education has occurred within industries. Similarly, past research has found that industry effects did *not* play a large role in the reduction of the earnings gap between men and women in the 1980's.[15]

Given that changes in industry composition do not explain the bulk of the changes in relative earnings, it is necessary to examine the reasons why changes within industries have occurred. Candidates for within-industry shifts in demand in favor of more educated workers include changes in technology that shift demand toward more skilled workers, "outsourcing" to foreign locations of activities previously performed by unskilled workers, and changes in management techniques that favor one group over another. Older workers may experience what is in effect a favorable within-industry demand shift when seniority provisions protect them from layoffs during the restructuring of an industry. Women, too, can find occupational patterns changing as discrimination lessens or as changing cultural mores lead to greater similarity in career pursuits across the genders.

Of the forces leading to shifts in demand for labor within industries, the one that has received the most attention is the influence of technical change on the demand for educated workers. A number of related hypotheses involving the connection between technical change and returns to education have been put forth. One explanation draws on work by Richard R. Nelson and Edmund S. Phelps, who suggest that "the rate of return to education is greater the more technologically progressive the economy."[16] This may occur because, in a technologically dynamic environment, educated workers have better "allocative ability in the sense of selecting the appropriate input bundles and of efficiently distributing inputs between competing uses,"[17] because educated workers have a comparative advantage in adjusting to and implementing new technology,[18] or because the introduction of new technology increases the need for learning by workers, and better educated workers are better learners.[19] Apart from these studies, the argument that the returns to education are higher in industries with rapid technological progress has received empirical support from a number of sources.[20]

Despite the empirical support for the linkage between technical change and returns to education at a given point in time, the findings about the relationship between technical progress and *changes* in the return to education over time are mixed. Alan Krueger observes that, because workers who use computers earn more than other workers, and because such workers are likely to be better educated, the expansion of computer use during the 1980's can account for an important part of the change in returns to education.[21] Similarly, Jacob Mincer has found that, over time, expenditures on research and development and on new capital equipment have had a positive impact on the education wage premium.[22] On the other hand, McKinley Blackburn, David Bloom, and Richard Freeman could not find evidence of such a relationship.[23]

Table 2. **Relative changes in the supply of all workers, 1973–89**

[Change in logarithm of share of employment × 100]

Demographic group	1973–89	1973–79	1979–89
Men	–9.7	–6.2	–3.5
Women	11.7	7.7	4.0
Years of schooling			
Men:			
0–11	–64.8	–29.9	–34.9
12	–6.5	–4.5	–2.0
13–15	11.1	8.3	2.7
16 or more	26.7	10.0	16.7
Women:			
0–11	–59.0	–23.2	–35.8
12	4.3	8.1	–3.8
13–15	46.4	25.0	21.4
16 or more	64.2	30.3	33.9
Years of potential experience[1]			
Men:			
0–9	–2.0	3.7	–23.8
10–19	31.3	7.0	24.3
20–29	–2.6	–18.4	15.8
30 or more	–47.0	–23.5	–23.5
Women:			
0–9	–4.8	11.2	–16.0
10–19	56.4	29.9	26.6
20–29	27.6	1.2	26.4
30 or more	–23.2	–12.5	–10.7

[1] Potential labor market experience is defined as age, minus number of years of schooling, minus 6 years, to account for the preschool period. It is used because the Current Population Survey does not measure *actual* labor market experience.

Wage-setting institutions. Finally, to shift focus to institutional factors that may have affected the wage structure, Blackburn, Bloom, and Freeman have found that, because of the existence of a union premium and the fact that the less educated are more likely to be union members, the decline in unionization in the United States has contributed to a widening of education-earnings differentials. Recent research has also determined that the decline in unionization is responsible for about one-seventh of the contraction of the gender gap. This result may be attributed to the fact that union membership rates have declined more slowly for women than for men, primarily because women were less concentrated in jobs where unionization was falling.[24] On the other hand, Blackburn, Bloom, and Freeman have found that the decline in the real value of the minimum wage has not played an important role in the changes in education-earnings differentials.[25]

Occupations and the demand for skills

To sum up the findings of recent research, the evidence suggests that while supply and institutional factors may have played some role, *demand* clearly has shifted in favor of more educated workers. Breaking this down even further, the shifts in demand have occurred primarily within, rather than across, industries. In light of these findings, it is natural to ask whether one can detect, in changes in occupational composition, a shift in demand for skills that would favor the demographic groups that performed well in the labor markets of the 1980's.[26] Before doing so, however, it is instructive to outline the connections among occupations, skills, and relative earnings. Much recent work has speculated that many of the changes in the earnings structure—particularly the rise in returns to education—have come about as a result of a rise in the return to *skill*.[27] The definition of *skill* is usually not made precise, but the term is often spoken of in connection with education, implying that skill is developed in school. In fact, the skills required on the job are multidimensional, and not all of them are the kind of skills developed through formal education. To use one taxonomy, David R. Howell and Edward N. Wolff write of jobs as being "defined by a set of tasks requiring some combination of motor skills (manual dexterity, motor coordination), interpersonal skills, organizational and managerial skills (leadership, autonomy and responsibility), verbal and language skills, diagnostic skills (synthetic reasoning abilities), and analytical skills (mathematical and logical reasoning abilities)."[28]

Measuring the demand for skills. Given the complexity of measuring the sets of skills required for just one job, it is apparent that determining the skill requirements for the economy as a whole, as well as changes in such requirements, is a difficult task. In light of the dearth of data directly measuring the skill requirements of jobs, an alternative approach is to focus on the occupational composition of the economy, as an occupation—if defined narrowly enough—can serve as a proxy for a set of skills. Using this approach, we can group changes in the skill requirements of jobs into three categories. First, shifts in the industrial composition of employment—resulting from changes in the demand for products and differences in productivity growth across sectors—will lead to changes in occupational composition and, thus, skill requirements because the distribution of employment by occupations differs across industries. For example, the secular shift of the economy away from manufacturing and toward services has contributed to a shift from blue-collar to white-collar work, leading to a decline in demand for the motor skills required in production work and an increase in the cognitive and interpersonal skills needed in clerical and professional positions.

Second, staffing patterns can change within industries themselves as a result of "outsourcing," changes in management techniques, and other factors. For example, if firms move production activities abroad in order to take advantage of a less expensive pool of blue-collar labor, the proportion of white-collar employment at these companies will increase.

Finally, the skills required in an occupation itself can change, often owing to the introduction of new technology. The spread of word processors, to cite one example, has had a marked effect on skills, requiring secretaries to learn how to use personal computers rather than typewriters and leading many professionals to do for themselves many of the clerical responsibilities previously performed by their secretaries.

Skill requirements and the earnings of demographic groups. How do skill requirements of the economy affect the earnings of particular demographic groups? It is perhaps easiest to explain how the demand for different sets of skills will cause earnings to differ across education groups. A number of theories have been put forth to describe the relationships among level of schooling, occupation, and earnings by education group. According to one view prominent among academic economists studying the labor market—known as *human capital theory*—schooling develops the skills required to perform the tasks in a particular occupation, and the resulting enhancement of productivity leads to higher earnings.[29] An alternative to human capi-

tal theory is that a key function of education is "screening," that is, identifying individuals with preexisting skills and abilities required in particular jobs. According to this view, education is used to sort individuals into occupations with different pay, rather than to develop the abilities needed for those occupations.[30] A number of other views on how education affects earnings through the intermediary of occupations exist as well. What is important to keep in mind is that, regardless of one's views on the connections among education, occupations, and earnings, the differences in earnings among education groups will depend fundamentally on the occupational structure of the economy. That is, the payoff to education will depend on two factors: the effectiveness of additional years of schooling in qualifying individuals for higher paying jobs than they would be likely to obtain without the additional schooling; and how wide the gap is between high-paying and low-paying jobs.[31] If changes in the skills that are demanded increase the likelihood that college graduates will move into high-paying occupations, and if the earnings of these high-paying jobs increase compared with those of other occupations, then the relative earnings of the more educated will increase.

The connections among experience, occupations, and earnings are similar to those among education, occupations, and earnings in some respects. Human capital theory asserts, analogously to the case of education, that with additional labor market experience, individuals will receive more on-the-job training, and the skills developed in this process will enable them to climb the occupational ladder and receive higher pay. An alternative view is that the skills of older workers may not differ much from those of younger workers, but seniority provisions have given the older workers more opportunities to move up in rank.

It is more difficult to make a case for why occupation distributions, and thus earnings, should differ across the genders because of skill differences, as there is no reason to assume that abilities should differ by gender (although differences in schooling and experience by gender may lead to differences in the development of skills). The human capital view does, however, offer an explanation based on skills: under the assumption that women will participate less in the labor force over the course of the life cycle (for example, because they may leave the labor force to care for a child), they will tend to invest in skills that do not depreciate as much during their time away from the labor force, and these skills will be suitable for particular occupations. For example, women, according to this view, would be unwilling to invest in the skills needed for many of the professional occupations, because while they were away from the labor force, these skills would tend to atrophy.[32] An alternative approach is that the culture of a society itself encourages men and women to follow different career paths, causing women to be "segregated" in occupations that, on the whole, tend to be less well paying than those held by men.[33] Finally, gender-related differences in occupational distributions may result from discrimination on the basis of gender.

From the preceding discussion, it is clear that there are ample reasons to expect demographic groups to be distributed differently across the economy's occupations. In some cases, these are the result of skill differences across groups, but in others, they are related to factors such as discrimination or seniority provisions. Regardless of their underlying cause, these differences in occupational structure across demographic groups will have an important impact on how the groups fare when the structure shifts: those more heavily concentrated in occupations in which demand is growing faster than average—as evidenced by employment growth or earnings increases or both—will tend to experience relative earnings gains.

Trends in employment and earnings

Employment by occupation. What were the important occupational employment shifts of the 1980's? Table 3 shows trends in occupational employment by the Census Bureau's major occupation groups. Most notable is the employment gain for sales occupations, up 3.2 percentage points in 1979–89. Other important gains were posted by executive, administrative, and managerial (up 1.5 points) and professional specialty (up 1.1 points) occupations, jobs where a high proportion of college graduates would be expected. On the other side of the ledger, a decline in blue-collar occupations is evident, particularly for machine operators (down 2.2 points) and precision production, craft, and repair occupations (down 1.6 points). These are occupations in which those without a college education historically have had a possibility of finding high-paying jobs. Administrative support occupations also showed a decline (1.1 points) in the period.

A clue as to whether the changes in the earnings structure in the 1980's were due to trends in occupational composition is provided by the degree to which the shifts during the 1980's differed from those in the 1970's. The decline of the blue-collar occupations clearly predated the 1980's, although it might have accelerated during that period. The growth of managerial and professional occupations also predated the 1980's. The only occupations in which there were

Table 3. **Employment shares and earnings of all workers by occupation, selected years, 1973–89**

Occupation	Employment shares (in percent)			Logarithm of earnings[1]		
	1973	1979	1989	1973	1979	1989
Executive, administrative, and managerial	9.2	9.8	11.3	10.24	10.13	10.19
Professional specialty	10.8	11.9	13.0	9.86	9.79	9.94
Technicians	2.5	3.0	3.6	9.72	9.71	9.85
Sales	8.5	8.1	11.3	9.12	9.03	9.24
Administrative support	17.5	18.4	17.3	9.24	9.25	9.35
Private household	1.3	.8	.7	7.48	7.39	7.58
Protective service	1.5	1.5	1.9	9.78	9.70	9.70
Other service	10.6	11.3	11.1	8.62	8.59	8.65
Farming, forestry, and fishing	2.2	1.9	1.9	8.50	8.53	8.60
Precision production, craft, and repair	13.7	13.0	11.4	9.92	9.89	9.84
Machine operators	11.2	9.7	7.5	9.40	9.46	9.40
Transportation and material-moving equipment	4.9	4.8	4.3	9.79	9.73	9.61
Handlers, cleaners, helpers, and laborers	6.2	5.7	4.8	9.09	9.07	8.93

[1] Earnings are deflated into 1989 dollars using the gross domestic product deflator for personal consumption expenditures.

important turnabouts between the two decades were sales and administrative support. The lack of a sharp contrast between the decades suggests that changes in occupational demand may not provide the complete explanation for the shifts in the earnings structure.

The changes in the occupational mix just noted can be attributed either to changes in industrial employment or to changes in occupational staffing patterns within industries. To determine which is the case, the following technique was used: the occupational composition for 1989 was predicted under the assumption that, for each industry, occupational staffing patterns did not change from 1979, so that the only changes in occupational employment that could have resulted were from shifts in industrial employment.[34] From these calculations, it is apparent that shifts in industrial employment generally have been in a direction consistent with the changing occupation mix. In other words, employment tended to shift toward those industries containing a relatively high proportion of the growing occupations and away from those sectors with a large share of declining occupations. The magnitudes of these shifts, however, are insufficient to predict the changes in occupational composition, indicating that other forces (such as technical change, "outsourcing," and changes in management techniques) were leading to shifts in staffing patterns within industries. For example, the method predicted that the share of executives, adminstrators, and managers in total employment would rise from 9.83 percent to 10.00 percent between 1979 and 1989, but the actual gain was to 11.30 percent.

Recent research has found some support for a role for technical change in shifting the composition of employment in manufacturing industries toward occupations requiring higher levels of education. For example, Ernst R. Berndt, Catherine J. Morrison, and Larry S. Rosenblum determined that the growth in white-collar, nonproduction-worker hours is positively related to increases in what they term the "high-tech composition of capital."[35] Similarly, Eli Berman, John Bound, and Zvi Griliches have found a shift away from production workers to be positively related to investments in computers and computer-related technology, as well as to expenditures on research and development.[36] It is an open question whether these results would hold for nonmanufacturing industries.

Earnings by occupation. Table 3 also provides earnings trends by Census Bureau major occupations. In the 1980's, those occupations with the fastest real earnings growth were sales (up 21 percent), private household occupations (up 19 percent), professional specialty occupations (up 15 percent), and technicians (up 14 percent). Those with real earnings declines were all blue-collar occupations, with the largest drops posted for handlers, cleaners, helpers, and laborers (down 14 percent) and transportation and material-moving equipment occupations (down 12 percent). In general, these trends suggest, not surprisingly, that occupations with more educated workers tended to experience gains in average earnings. The implications of the trends for gender and experience differentials are less transparent.

In contrast to the case of employment, earnings trends show a clear shift across decades. Some of the white-collar occupations—for example, executive, administrative, and managerial occupations, as well as professional specialty occupations—that did reasonably well in the 1980's had fared poorly in the 1970's; and blue-

collar machine operators, whose average earnings declined in the 1980's, had been among the few gainers in the 1970's.

Changes in the demand for skills

What have been the implications of the shifts in occupational demand for changes in the demand for skills? As previously described, changes in the demand for skills can come from shifts in industrial composition, changes in occupational patterns within industries, and changes in the skills required by occupations.

Impact of occupational and industrial employment shifts. The changes in occupational composition discussed in the previous section, which incorporate the impact of the first two categories of change mentioned, indicate that in the 1980's, demand was growing for the skills required in professional and managerial occupations. In these occupations, cognitive and interpersonal skills tend to be in high demand, but motor skills do not. Again, it is important to keep in mind that, in terms of compositional shifts, the 1980's may represent an *acceleration* in the rate at which the demand for cognitive and interpersonal skills is increasing, but not a major break from previous trends.

A study by Kevin M. Murphy and Finis Welch for the period 1940–90 has arrived at a finding consistent with the view that the demand for skills does not show a major break in trend in the 1980's.[37] Using education as the measure of skill,[38] they found that over this period employment shifted toward occupations with higher levels of schooling, but that there was no evidence that the demand for education grew particularly rapidly in the 1980's. In another study assessing the impact of changes in industrial and occupational composition on cognitive, interactive, and motor skill requirements, Howell and Wolff[39] determined that, with the exception of motor skills, changing employment patterns have had the effect of raising skill requirements. But they also found a sharp deceleration in the rate of growth in these requirements between 1960 and 1985.

The changing skill requirements of jobs. The studies just mentioned provide a perspective on the effects of occupational and industrial employment shifts on the skill requirements of jobs. But the lack of good data makes it difficult to assess trends in the third category of shifts affecting changes in the demand for skills: the skill requirements of jobs. For many years, there has been an ongoing debate in the social sciences about the effects of new technology on the demand for skills. One view is that technical change tends to increase the demand for cognitive skills as the need for physical labor is reduced by automation. Another philososophy holds that technology is inherently "de-skilling," as management tries to reduce the amount of control workers have over their jobs. Yet a third school of thought argues that it is not possible to determine from first principles the effect of new technology on the demand for skills.[40] In a recent study of manufacturing establishments in the 1980's, Peter Cappelli has found that there was a significant increase in the level of skills required for most production jobs, but that clerical jobs are evenly split between those that have been "upskilled" and those that have been "deskilled."[41] Except for some cases studies, the literature is virtually silent on trends in the skill requirements of other occupations within manufacturing and of nonmanufacturing as a whole.

Quantitative aspects of the changes

Demand indexes. As a first pass at assessing whether the changes in occupational demand noted in the previous section play an important role in the changes in relative earnings by demographic group, an index of demand based on occupations is devised. For a given demographic group i, the shift in demand relative to other groups can be calculated as the weighted percent change in employment share by occupation; that is,

$$\frac{\Delta D_i}{D_i} = \sum a_{ij} \frac{\Delta \mathrm{EMP}_j}{\mathrm{EMP}_j}, \tag{1}$$

where D_i is the demand for demographic group i, a_{ij} is the proportion of that group employed in the jth occupation in the base year, and EMP_j is the share of employment in the jth occupation. Table 4 shows this measure for different demographic groups; the occupations are the Census Bureau's detailed occupations listed in the technical documentation to the CPS, the sample is all workers, and the measure is computed as an annual average.[42]

If workers of a particular group are overrepresented in an occupation, the growth of employment in that occupation will tend to increase the demand for that group and thus raise its relative pay. The demand indexes will then be highest for groups that are concentrated in growing occupations. Which groups have benefited most from the shifts in occupational demand during the 1980s? Table 4 indicates clearly that occupational shifts favored the more educated: for both men and women, the changes in the demand index are ordered by education. It is apparent, though, that this trend did not begin in the 1980's: in 1973–79, the demand for college graduates grew more quickly than for high school gradu-

ates and dropouts, for both men and women. The magnitudes of the changes do indicate, however, a modest acceleration in the shift toward the more highly educated in the 1980's, one that may even be greater than indicated here because demand shifts were highest for those groups with increasing earnings.

Categorical statements about which experience groups were favored by shifts in occupational demand are much harder to make. For both men and women, the differences in changes in the occupational demand index across experience groups were relatively small in the 1980's. For men, there is no apparent order to the shifts, while for women, the less experienced appear to have benefited more.

In light of the strong earnings gains by women relative to men during the 1980's, it is striking to note that shifts in occupational demand, at least by this measure, did not favor females. Shifts in occupational demand were actually slightly more favorable toward men than women in the 1980's, the opposite of the situation in the 1970's. This suggests that we must look outside the realm of changes in occupational demand to determine why women's earnings gained ground on men's during the 1980's.

Table 4. **Annual average relative changes in demand based on detailed occupations, all workers, 1973–89**

Demographic group	1973–89	1973–79	1979–89
Men	–0.25	–0.24	–0.23
Women	–.36	.03	–.38
Years of schooling			
Men:			
0–11	–.96	–.88	–1.04
12	–.46	–.44	–.62
13–15	.22	.14	.19
16 or more	1.00	.99	1.05
Women:			
0–11	–1.04	–.99	–.98
12	–.36	.16	–.56
13–15	.07	.77	–.08
16 or more	.34	.51	.43
Years of potential experience[1]			
Men:			
0–9	–.33	–.29	–.32
10–19	–.12	–.11	–.07
20–29	–.09	–.09	–.13
30 or more	–.35	–.35	–.33
Women:			
0–9	–.23	.30	–.26
10–19	–.37	.05	–.36
20–29	–.35	.01	–.45
30 or more	–.56	–.37	–.57

[1] Potential labor market experience is defined as age, minus number of years of schooling, minus 6 years, to account for the preschool period. It is used because the Current Population Survey does not measure *actual* labor market experience.

Regression analysis. Although the preceding results are suggestive, it is useful to quantify the impacts of occupational shifts on relative earnings. To do this, regression-decomposition analysis is used. This framework is a convenient tool for attributing changes in a given earnings differential (for example, that between college graduates and high school graduates, or between those with 20 to 29 years of experience and those with 0 to 9 years of experience, or between men and women) to shifts in the distribution of occupations. The technique is applied in terms of education-earnings differentials as follows: a regression for the base year (year s) is run, regressing (ln) earnings on variables representing years of schooling, years of potential labor market experience, race, region, whether the individual lived in a metropolitan area, part-time status, and weeks worked. The formula is

$$\text{(2)} \quad \ln \text{Earnings} = a_{0s} + a_{1s}\text{LTHS} + a_{2s}\text{HS} + a_{3s}\text{SOME} + a_{4s}\mathbf{X} + e,$$

where LTHS is a variable indicating that the individual has less than a high school education; HS is a variable indicating that the individual has a high school education; SOME is a variable indicating that the individual has some college; **X** is a vector representing the other variables mentioned; the a_{is}'s are the corresponding coefficients for the year s, and e is an error term. The coefficients on the variables representing the schooling groups can be used to measure the average difference in earnings between one group and another, after controlling for other relevant variables that affect earning power. For example, a_{2s} measures the difference between earnings of high school graduates and college graduates. This same regression is then rerun for the end year, year t, and the change in the coefficients for schooling groups can be used to measure the change in relative earnings by schooling group. (For example, $a_{2s} - a_{2t}$ measures the change in the college graduate–high school graduate differential between year s and year t).[43]

The same exercise is then repeated for the beginning and ending year of the period, this time including in the regressions variables representing the individual's occupations:

$$\text{(3)} \quad \text{In Earnings} = b_{0s} + b_{1s}\text{LTHS} + b_{2s}\text{HS} + b_{3s}\text{SOME} + b_{4s}\mathbf{X} + b_{5s}\mathbf{OCC} + e.$$

Here, the vector of occupation variables, **OCC**, controls for the differences across education groups in the distribution of these groups across occupations, as well as for differences in average earnings across occupations. Calculating the change in education-earnings differentials across years in this specification gives the change in relative earnings "net" of occupation factors (for example, $b_{2s} - b_{2t}$). Comparing the change in dif-

ferential "net" of occupation factors with the previously calculated change (for example, $a_{2s} - a_{2t}$) allows a calculation of the share of the education-earnings differential that can be attributed to occupational factors. To summarize, changes in occupational demand will have two effects that lead to changes in relative earnings by demographic group. The first effect is to change the distribution of demographic groups across occupations, benefiting those groups with relative shifts to higher paying jobs. The second effect is to change the earnings premium associated with particular occupations, which favors those groups disproportionately concentrated in occupations with rising earnings premiums. It is also possible to assess the impact of industry factors in the same way, as will be done momentarily.

What would have happened to education-earnings differentials in the 1980's in the absence of shifts in occupational demand? Table 5 indicates that these differentials would have widened, but by a substantially smaller amount. For example, the differential between male college graduates and high school graduates increased by 16 percent, but without the shifts in occupational demand, this differential would have widened by 10 percent. And controlling for shifts in occupational demand reveals that the earnings of male college graduates relative to high school dropouts would have increased by 16 percent instead of 23 percent. The results for education-earnings differentials for females are similar, with occupational effects accounting for roughly one-third of the widening gap. In other words, as suggested, college graduates have benefited disproportionately from the changes in occupational demand: relative to those with less education, they were able to shift into better paying jobs (such as those in the professions and management), and the jobs that they tended to hold became higher paying in relative terms as well (as shown in table 3).

Table 5 also shows how important industry factors have been in the widening of education-earnings differentials. In general, shifts in industry demand have not been quite as significant as changes in occupational structure. Finally, table 5 indicates that industry and occupation factors working together are not that much more potent than the effect of each separately, a reflection of the fact that many occupations are concentrated in a small number of industries.

Table 6 shows the result of an exercise conducted for experience-earnings differentials similar to the exercise carried out to generate table 5. As noted earlier, the increase in returns to experience during the 1980's was less dramatic than the rise in returns to education, providing less scope for occupational factors to have played a role. Even so, it is striking to note how little shifts in occupational demand have affected returns to experience: the inclusion of controls for occupation has virtually no impact on the changes in relative earnings by experience group. The same is true for the effect of industry controls.

Occupational factors played a nonnegligible, but still fairly small, role in the earnings gain of women relative to men during the 1980's, accounting for roughly one-quarter of the gain, as shown in table 6. Given the popular perception that women recently have made further inroads into the professions, it may seem surprising that they have not experienced greater movement into higher paying jobs relative to men. It should be kept in mind, however, that the secular increase in the labor force participation of women has meant an increase in the number of women in jobs across the entire earnings distribution, not just at the top. In addition, while the decline in high-paying blue-collar jobs certainly hurt men more than women, men benefited more from the rise in pay in the professional occupations, given their greater concentration there.

Table 5. **Adding occupation and industry controls to estimates of education-earnings differentials, all workers, 1973–89**

Demographic group	Period	Change in differential	Change in differential, controlling for occupation	Change in differential, controlling for industry	Change in differential, controlling for occupation and industry
Male college graduate—					
High school graduate	1973–79	–0.04	0.01	–0.02	0.01
High school graduate	1979–89	.16	.10	.11	.09
Less than high school graduate	1973–79	–.03	–.03	.01	–.04
Less than high school graduate	1979–89	.23	.14	.16	.12
Female college graduate—					
High school graduate	1973–79	–.06	–.03	–.05	–.03
High school graduate	1979–89	.14	.09	.09	.07
Less than high school graduate	1973–79	–.07	.00	–.05	.00
Less than high school graduate	1979–89	.21	.13	.14	.10

Table 6. **Adding occupation and industry controls to estimates of experience-earnings and gender-earnings differentials, all workers, 1973–89**

Demographic group	Period	Change in differential	Change in differential, controlling for occupation	Change in differential, controlling for industry	Change in differential, controlling for occupation and industry
Men:					
10–19 years . .	1973–79	–0.02	–0.01	–0.02	–0.02
10–19 years . .	1979–89	–.01	.00	–.01	–.00
20–29 years . .	1973–79	.01	.03	.01	.02
20–29 years . .	1979–89	.03	.04	.02	.03
30 or more years	1973–79	.03	.03	.03	.02
30 or more years	1979–89	.07	.07	.06	.07
Women:					
10–19 years . .	1973–79	.01	.01	.01	.01
10–19 years . .	1979–89	.07	.06	.06	.06
20–29 years . .	1973–79	–.02	–.03	–.02	–.03
20–29 years . .	1979–89	.11	.09	.09	.08
30 or more years	1973–79	.00	.00	.00	.00
30 or more years	1979–89	.04	.04	.03	.03
Men-women	1973–79	–.11	–.12	–.12	–.13
	1979–89	–.11	–.08	–.09	–.07

NOTE: For experience-earnings differentials, base = 0–9 years of potential labor market experience.

Summary and conclusions

Several interesting findings have emerged from the analysis presented in this article. During the 1980's, for education-earnings differentials, shifts in occupational demand accounted for roughly one-third of the change in the gap. The analysis indicates, however, that the rise in the demand for skills possessed by more educated workers is not a new phenomenon: changes in the occupational mix during the 1980's marked no abrupt departure from patterns in the 1970's. In light of this relative stability, why were the changes in the earnings structure so different across the decades? Partly, this is due to a mismatch between the growth in the demand for more educated workers and the increase in the supply of such workers: during the 1970's, the entry into the work force of highly educated baby-boomers helped meet the growing demand for more educated workers, but in the 1980's, the growth of the proportion of college graduates in the work force decelerated as smaller cohorts entered the market.[44]

What other factors explain the change in education-earnings differentials that occupational forces do not? Aside from the factors already mentioned, it seems likely that there was an increase in the return to the general skills possessed by college graduates (for example, the analytical and cognitive skills that are not specific to a particular job), and not just to the more specialized skills demanded in the types of occupations college graduates tend to fill.[45]

Shifts in occupational and industrial demand turn out to be relatively unimportant in explaining changes in returns to experience during the 1980's. Supply-side shifts also do not seem to be part of the story: while the growth in the supply of less experienced workers was important in explaining the rise in returns to experience in the 1970's, the work force actually became more experienced in the 1980's as the baby-boomers aged. Katz and Murphy speculate that the rise in returns to experience—having been concentrated among the less educated—was actually related to the forces leading to the rise in returns to education.[46] Because older workers tend to be insulated from labor market forces by seniority provisions, and because they might possess skills specific to a firm, younger, less educated workers would tend to be hit harder than their older counterparts by the forces tilting demand toward workers with higher levels of schooling.

Changes in occupational demand played a nonnegligible, but small, role in narrowing the earnings gap between men and women in the 1980's. What else has been important? As mentioned earlier, the disproportionate effect of the decline in unionization on men is one factor. In addition, a decline in differences across the genders in actual labor market experience and in the return to that experience has been found to have been important. Finally, a decline in discrimination may have had an impact as well. ▯

Footnotes

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[1] See Claudia Goldin and Robert A. Margo, "The Great Compression: The Wage Structure in the United States at Mid-Century," *Quarterly Journal of Economics*, February 1992, pp. 1–34, for a long-term view of U.S. earnings inequality trends.

[2] For a survey of this literature, see Frank Levy and Richard J. Murnane, "U.S. Earnings Levels and Earnings Inequality: A Review of Recent Trends and Proposed Explanations," *Journal of Economic Literature*, September 1992, pp. 1333–81.

[3] One reason for the lack of focus on actual jobs in the economy is that changes in the occupational classification scheme by the Census Bureau have made it difficult to compare the occupational structure of the economy before and after 1983. To circumvent this problem, occupation data taken from the CPS before 1983 were recoded in post-1983 terms. (See the appendix at the end of the article.)

[4] It should be stressed at the outset that skills are not the only factor involved in the distribution of demographic

groups across jobs. For example, differences between men and women in occupational attachment may be due to discrimination—both before entry into the labor market and at the workplace—and older workers may be higher up on the job ladder than their younger counterparts due to seniority.

[5] In this table, average earnings are calculated only for full-time, year-round workers, in an attempt to control for differences in hours worked across groups. To assess trends in as broad a portion of the labor force as possible, the remaining tables include all workers and use regression techniques where appropriate to control for differences in hours worked.

[6] The CPS is a monthly survey of approximately 60,000 households conducted by the Bureau of the Census for the Bureau of Labor Statistics. For inclusion in the samples used in the analysis presented in this article, the individual (1) had to be between the ages of 18 and 64 years, (2) could not be self-employed, and (3) had to have worked at least 1 week during the year in the civilian economy. Note in table 1 that because the March 1974 CPS does not contain a continuous variable for weeks worked and usual hours worked, it is not possible to calculate an hourly wage rate for all 3 survey years combined.

[7] Throughout this article, changes in the natural logarithm of earnings are used to approximate percent changes in earnings.

[8] Because the CPS does not measure actual labor market experience, potential labor market experience is used instead. This is defined as age, minus number of years of schooling, minus 6 years, to account for the preschool period. In some cases, the result of the calculation is a negative number, so a zero is substituted.

[9] For women, the patterns are less clear and the significance even less so, given that the number of years of potential experience may not be a good proxy for actual labor market experience for many women and that the relationship between these two has changed over time as women's labor force participation has risen.

[10] See, for example, Finis Welch, "Effects of Cohort Size on Earnings: The Baby Boom Babies' Financial Bust," *Journal of Political Economy*, Vol. 87, pp. S65–S97.

[11] There are a number of alternative methods for calculating supply indexes. The indexes shown here measure the logarithm of the change in the share of employment of all workers by demographic group. It would have been preferable to weight the employment by the number of hours worked during the year, but this was not done because the March 1974 CPS does not contain data on usual hours worked per week, and the data for weeks worked during the year are grouped into categories. Another alternative (see Lawrence F. Katz and Kevin M. Murphy, "Changes in Relative Wages, 1963–87: Supply and Demand Factors," *Quarterly Journal of Economics*, February 1992, pp. 35–78) would be to use an efficiency unit concept, where employment is weighted by earnings. The evidence indicates that all of the alternatives provide similar results.

[12] See George J. Borjas, Richard B. Freeman, and Lawrence F. Katz, "On the Labor Market Effects of Immigration and Trade," NBER Working Paper No. 3761, June 1991.

[13] See June O'Neill and Solomon Polachek, "Why the Gender Gap in Wages Narrowed in the 1980's," *Journal of Labor Economics*, January 1993, pp. 205–28. This is an issue that cannot be explored using the CPS, since, as mentioned earlier, that survey can measure only potential rather than actual labor market experience.

[14] See, for example, McKinley L. Blackburn, David E. Bloom, and Richard B. Freeman, "The declining economic position of less-skilled American men," in Gary Burtless, ed., *A Future of Lousy Jobs?* (Washington, DC: The Brookings Institution, 1990). See also Paul Ryscavage, "Gender-related shifts in the distribution of wages," this issue, pp. 3–15.

[15] See Francine D. Blau and Lawrence M. Kahn, "Race and Gender Pay Differentials," in David Lewin, Olivia S. Mitchell, and Peter D. Sherer, eds., *Research Frontiers in Industrial Relations and Human Resources* (Madison, WI, Industrial Relations Research Association Series, 1992).

[16] Richard R. Nelson and Edmund S. Phelps, "Investment in Humans, Technological Diffusion and Economic Growth," *American Economic Review*, May 1966, p. 75.

[17] See Finis Welch, "Education in Production," *Journal of Political Economy*, January/February 1970, pp. S65–S97.

[18] See Ann P. Bartel and Frank R. Lichtenberg, "The Comparative Advantage of Educated Workers in Implementing New Technology," *Review of Economics and Statistics*, February 1987, pp. 1–11.

[19] See Ann P. Bartel and Frank R. Lichtenberg, "Technical Change, Learning and Wages," NBER Working Paper No. 2732, October 1988.

[20] See Lee A. Lillard and Hong W. Tan, "Private Sector Training: Who Gets It and What Are Its Effects?" Rand Corporation, March 1986; Indermit S. Gill, "Technological Change, Education and Obsolescence of Human Capital: Some Evidence for the U.S.," unpublished manuscript, November 1989; Jacob Mincer and Yoshio Higuchi, "Wage Structures and Labor Turnover in the U.S. and in Japan," *Journal of the Japanese and International Economies*, June 1988; and Jacob Mincer, "Human Capital Responses to Technological Change in the Labor Market," NBER Working Paper No. 3207, December 1989.

[21] See Alan Krueger, "How Computers Have Changed the Wage Structure: Evidence from Microdata," *Quarterly Journal of Economics*, February 1993, pp. 33–60.

[22] See Jacob Mincer, "Human Capital, Technology and the Wage Structure: What Do Time Series Show?" unpublished manuscript, August 1991.

[23] Blackburn, Bloom, and Freeman, "Less-skilled American men."

[24] See William E. Even and David A. Macpherson, "The Decline of Private-Sector Unionism and the Gender Wage Gap," *Journal of Human Resources*, Spring 1993, pp. 279–98.

[25] Blackburn, Bloom, and Freeman, "Less-Skilled American Men."

[26] Focusing on changes in occupational demand as a measure of changes in demand for labor within industries is an approach that is complementary to assessing the impact of technical change and other within-industry forces mentioned earlier.

[27] See, for example, Chinhui Juhn, Kevin M. Murphy, and Brooks Pierce, "Wage Inequality and the Rise in Returns to Skill," *Journal of Political Economy*, June 1993, pp. 410–42.

[28] See David R. Howell and Edward N. Wolff, "Trends in the Growth and Distribution of Skills in the U.S. Workplace, 1960–85," *Industrial and Labor Relations Review*, April 1991, p. 487.

[29] See Gary S. Becker, *Human Capital* (New York, National Bureau of Economic Research, 1964), for an early elaboration of this view.

[30] See, for example, Paul J. Taubman and Terence J. Wales, "Higher Education, Mental Ability and Screening," *Journal of Political Economy*, Vol. 81, 1973.

[31] For a discussion of the extent to which college graduates take jobs that do not require a college degree, see Daniel Hecker, "Reconciling conflicting data on jobs for college graduates," *Monthly Labor Review*, July 1992, pp. 3–12.

[32] For an exposition of this aspect of the human capital theory, see Solomon William Polachek, "Occupational Self Selection: A Human Capital Approach to Sex Differences in Occupational Structure," *Review of Economics and Statistics*, February 1981, pp. 60–69.

[33] For a recent analysis of segregation by gender and its impact on the earnings gap between men and women, see Judith Fields and Edward N. Wolff, "The Decline of Sex Segregation and the Wage Gap," *Journal of Human Resources*, Fall 1991, pp. 608–22.

[34] The distribution of employment in the Census Bureau's 13 major occupations was calculated for each of the Census Bureau's 44 detailed industries at the beginning of the period. Assuming that the proportion of employment by occupation stayed constant, the distribution of employment by industry at the end of the period can be used to predict what the occupational composition would have been, given that staffing patterns did not change within industries.

[35] See Ernst R. Berndt, Catherine J. Morrison, and Larry S. Rosenblum, "High-Tech Capital Formation and Labor Composition in U.S. Manufacturing Industries: An Exploratory Analysis," NBER Working Paper No. 4010, March 1992.

[36] See Eli Berman, John Bound, and Zvi Griliches, "Changes in the Demand for Skilled Labor within U.S. Manufacturing Industries: Evidence from the Annual Survey of Manufacturing," unpublished manuscript, August 1992.

[37] See Kevin M. Murphy and Finis Welch, "Occupational Change and the Demand for Skill, 1940–90," *American Economic Review*, May 1993, pp. 122–26.

[38] It should be kept in mind that there is some controversy over the use of education as a measure of skill. The level of education of those in the work force will be influenced not only by the demand for skills developed in formal schooling, but also by the supply of skills, which in turn will be influenced by how well society can afford schooling. In other words, the well-known increase in the average schooling level of the work force is a result not only of rising demand for schooling, but also of society's increased ability to afford it. In addition, Howell and Wolff argue that "the usefulness of schooling measures is limited by such well-known problems as variations in the quality of schooling, both over time and among regions, the use of credentials as a screening mechanism, and inflationary trends in credential and certification requirements" (Howell and Wolff, "Growth and Distribution of Skills," pp. 487–88). They also note that, while educational indices are highly correlated with cognitive and interactive skills, this is not the case for motor skills.

[39] Howell and Wolff, "Growth and Distribution of Skills."

[40] For a more detailed discussion of the issue, see Peter Cappelli, "Are Skill Requirements Rising? Evidence from Production and Clerical Jobs," *Industrial and Labor Relations Review*, April 1993, pp. 515–30.

[41] Cappelli, "Are Skill Requirements Rising?"

[42] There are many other ways to calculate this measure. Ideally, the measure would control for hours, but because of limitations in the CPS noted earlier, that is not possible. An alternative control for hours is to use only full-time, year-round workers, which gives results qualitatively similar to those shown in the table. Katz and Murphy, "Changes and Relative Wages," argue that wages of workers should be taken into account as well, to measure employment in terms of efficiency units. Again, it is unlikely that such a procedure will lead to results very different from the ones shown in the table.

[43] The changes in relative earnings by demographic group calculated in this way give a picture similar to one that could be calculated from the earnings trends shown in table 1. There are two important differences, however: first, in the current calculations, regression techniques are used to control for other factors that may affect earnings; second, the sample here includes all workers, rather than just full-time, year-round workers, with differences in hours worked across individuals controlled for by the inclusion of variables for part-time status and weeks worked.

[44] For a further discussion of this issue, see Katz and Murphy, "Changes in Relative Wages."

[45] Some support for this notion is found in Erica Groshen, "Rising Inequality in a Salary Survey: Another Piece of the Puzzle," Federal Reserve Bank of Cleveland Working Paper No. 9121, December 1991.

[46] See Katz and Murphy, "Changes in Relative Wages."

APPENDIX: Data and methods

Occupational recoding. The Census Bureau made dramatic changes in the scheme it used to classify occupations between the 1970 and 1980 Censuses of Population. Because the same scheme is used in the Current Population Survey, it is now exceedingly difficult to compare the occupation structure before 1983 (when the 1980 occupation system was adopted) with that after 1983. The Census Bureau has, however, developed imputation techniques to assign 1980 occupation codes to individuals, based on their 1970 occupation code and a number of demographic characteristics. (See Lynn Weidman, *Final Report: Industry and Occupation*, SRD Research Report Number Census/SRD/89/03, Aug. 20, 1989.) The Census Bureau generously provided the Bureau of Labor Statistics with the software used to recode occupations in the 1970 census, and this software was then adapted for use with pre-1983 Current Population Surveys. Because the techniques involved rely on imputation, rather than on an exact match between 1970 and 1980 occupations, the Census Bureau recommends that they be applied five times and the results of statistical analyses be averaged over these five imputations. This is the approach followed in the body of this article.

Top coding. One difficulty in using the Current Population Survey to study relative earnings trends is that the true value of an individual's earnings is not revealed if the individual earned more than the amount specified in a top code. To circumvent this problem, earnings reported below the top code were fit to a Pareto distribution, and the parameters of the distribution were then used to predict the mean value of earnings for those above the top code.