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HIGHLIGHTS

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IS THERE A SKILLS CRISIS?

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A leading explanation for the large growth of wage inequality in the United States during the 1980s is a widening gap between the demand for and supply of more-skilled workers (Katz and Murphy 1992). This followed a decade in which economists, sociologists, and policymakers were concerned about overeducation and a glut of high-skilled workers relative to the number of jobs that could make full use of their skills (e.g., Berg 1971; Freeman 1976; U.S. Department of Health, Education, and Welfare 1973). In just a few years, glut seemed to have turned into serious shortage, even more remarkable since most workers in the 1980s were also in the labor force in the 1970s.

But is it true? Is the growth in inequality in the 1980s attributable to historically large shifts in job skill requirements favoring the more skilled? The dramatic growth of computers and microelectronics gives the argument plausibility, but the relationship between those technologies and job skill requirements is not easily demonstrated.

Further, it is not sufficient to show a relationship between technology and the demand for more-skilled workers; it must be shown that the rate of technological change that shifts demand in favor of high-skilled workers *accelerated* during the 1980s if one is to explain the exceptional growth of inequality during that decade, since economists generally acknowledge that technology was raising skill requirements for many decades prior to the spread of computers (Mishel and Bernstein 1994; Mishel, Bernstein, and Schmitt 1997). This has led some advocates of the skill-biased technological change thesis to suggest that the cause of the skills gap may not be a technology-induced acceleration in the demand for skill but a slowdown in the growth of educational attainment or supply of skilled workers (Katz and Murphy 1992; Autor, Katz, and Krueger 1998).

Clearly, the two versions of the skills mismatch hypothesis imply very different views of the underlying processes generating inequality

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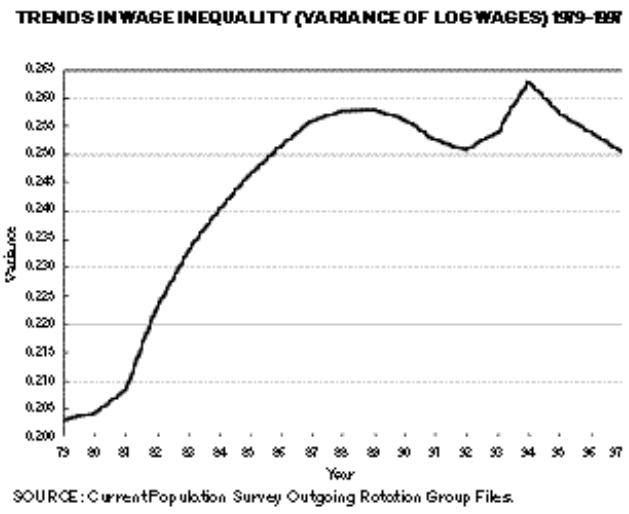
growth. The demand-side explanation is consistent with the postindustrial vision in which high technology has dramatically upgraded skill requirements, while the supply-side explanation suggests no break with the past in terms of technology's effect on skill requirements, explaining the skills shortage as a failure of the educational system to keep up with a secular trend in technology compared to the past. In fact, neither explanation is well-supported.[1]

The Argument against the Skills Mismatch Theory

Most inequality growth occurred in the early 1980s, before both the widespread diffusion of computers and the slowdown in educational attainment. The figure below uses the variance of log wages, a common measure of inequality, to show the very rapid growth of inequality early in the period prior to the greatest diffusion of computer use. In fact, about 50 percent of the growth of inequality between 1979 and 1993 occurs in the years 1981 to 1983, coinciding with the deepest recession in U.S. history since the Great Depression, but still very early in the process of computer diffusion.

Educational data show that workers' average years of education rose at a steady rate between 1962 and 1983, then slowed between 1983 and 1991 and flattened further



SOURCE: Current Population Survey Outgoing Rotation Group Files

between 1992 and 1997. This implies that any skills gap owing to a supply-side slowdown would begin in the mid-1980s and grow progressively more severe in the 1990s. But inequality growth moderated in the late 1980s and has remained largely flat since then. It is also pertinent to note that inequality in educational attainment among workers declined steadily between 1970 and 1986 before flattening out, despite popular perceptions of increased inequality in educational attainment.

The argument that computer use raises job educational requirements is dubious. Statistical analyses show that computer users have more education than do otherwise similar workers; the difference is on the order of one-half to one year, depending on the controls included in the model (Handel 2000a). But these results do not settle the issue. Firms that could afford computers may have been able to afford more-educated workers as well. Or they may have initially given computers to more-educated workers because they had higher status or held positions in which computers were most complementary to their tasks, such as office work. In these cases the association in the cross-sectional models between computer use and higher educational level would not imply a causal link between the two.

Despite the problems in determining causality, it is useful to note that the educational upgrading effect of computers is not likely, even by relatively generous estimates, to exceed one year of education, which at least provides an upper bound and a caution for those who would see computers as dramatically upgrading the educational requirements of work. Even in the most favorable case, computers are not typically leading to the replacement of workers who have a high school education with workers who have a four-year or even a junior college education.

Even when one examines the specific tasks that workers perform with computers, one does not find convincing evidence of an educational upgrading effect. Workers using computers for inventory and invoice functions have less education (about 0.2 fewer years) than otherwise similar workers. Workers using the Internet, spreadsheets, and word processing programs have the greatest educational advantage (about 0.3 years) over otherwise similar

workers, while workers using computers for programming or computer aided design are little different from otherwise similar workers (Handel 2000a). This does not reflect one's expectations regarding the relative skill requirements of these different tasks. In short, specific computer tasks do not seem to be reliably related to educational differentials (see also DiNardo and Pischke 1997, Handel 1999 for evidence on wages).

Longitudinal data can be used to examine the effects of changing computer use on changes in educational requirements, which most researchers would agree provide a stronger test of causality than cross-sectional results. But examining the association between changes in the educational composition of occupations and changes in the level of computer use within occupations makes the case for computer impacts even more dubious. Using data for 1984 and 1997, statistical analyses imply that if an occupation went from having no computer users to 100 percent computer users, the mean education of workers in the occupation would increase by 0.2 years, well below even the lower-bound estimate of 0.5 years mentioned above (Handel 2000a).

Further analyses suggest that even these associations do not likely reflect a causal connection between computer use and occupations' educational requirements. When changes in educational levels within occupations for 1971 to 1976 are related to changes in computer use within occupations for 1984 to 1997 the results are remarkably similar (Handel 2000a). It appears that the growth of computer use at a later point in time is as good a predictor of educational upgrading in the past as it is a predictor of contemporaneous educational upgrading within occupations! In other words, occupations that increased their computer use most in the 1980s were already upgrading educational levels for other reasons in the early 1970s, prior to the diffusion of computers.

The rapid decline in the demand for blue-collar workers in the past two decades has been cited by some as evidence of the effect of computers on wage inequality. It has been argued that automation and computer-controlled processes made lower blue-collar workers redundant in unprecedented numbers. But there is little evidence for this. The rapid decline for such workers occurred during the early 1980s, prior to the widespread diffusion of computer or other advanced microelectronics, suggesting that the recession and trade deficits of the early 1980s, rather than an upsurge in factory automation and consequent labor displacement, were responsible for the observed trends. Further, the correspondence of this trend with the growth in inequality in the early 1980s suggests the importance of the decline of blue-collar manufacturing work for inequality growth (Bluestone and Harrison 1983; Harrison and Bluestone 1988), rather than the emergence of an information economy. One can say with reasonable confidence that the trend has been one of general upgrading of job skill levels, but trends in the 1980s and 1990s do not appear to have accelerated—despite the growth of information technology—in marked contrast to trends in wage inequality.

The lack of an effect of computers on the U.S. occupational composition is not limited to broad occupational groups. Even many specific occupations that might appear to be most sensitive to technological change show modest or no effects. One can think of two possible kinds of effects of computers on specific occupations that might influence inequality. The information economy might demand a rapid increase of more-skilled jobs at the top of the occupational hierarchy and/or automation might eliminate large numbers of less-skilled jobs at the bottom.

Starting at the top, the growth rate of computer scientists and systems analysts as a percentage of the work force has increased from 0.02 percentage points per year (1971–1982) to 0.06 percentage points per year (1983–1997), but this group still accounts for just about 1 percent of the work force. The growth rate of computer programmers has not accelerated at all since the 1970s and this group accounted for only about one-half of one percent of the work force in 1997. The growth rate of the broader category of scientists, engineers,and technical workers did accelerate in the 1980s and 1990s, but they accounted for only 5.3 percent of the work force in 1971 and only 7.4 percent of the workforce 26 years later in 1997. Although there is much talk about the increasingly technical nature of work, there is little evidence that computer-related, or technical work more broadly

defined, accounts for a large share of the workforce in absolute terms or relative to levels in the 1970s, before the large growth of wage inequality.

Nor does it seem to be true that computers or other information technology are eliminating jobs at the bottom of the skill hierarchy, despite the assumptions of many in the inequality debate that this is the case (e.g., Danziger and Gottschalk 1995, 141). Grocery store cashiers, retail clerks, bank tellers, telephone operators, postal clerks,and automobile welders and painters show little decline or patterns of decline that are not consistent with a simple account of automation and displacement resulting from the information technology diffusion since the early 1980s, despite the prominence of bar-code scanners, ATMs, industrial robots, and other automatic equipment in these lines of work.

Worker surveys that examine the level of education required for various jobs indicate that there has been a growth in job skill requirements but no real acceleration between the late 1960s and the mid-1980s. Inequality in job skill requirements also steadily declined during this period, despite the growth in wage inequality. If the appearance of computers in the workplace in large numbers dramatically increased education or job training requirements, there is little evidence of it in these figures.

Policy Implications

The preceding findings cast doubt on claims that the growth of wage inequality in the last 20 years is due to a skills shortage, whether driven by an acceleration in the demand for skill arising from the diffusion of advanced information technology or a deceleration in the growth of the supply of skilled labor.

The heavy concentration of inequality growth in the recession years of the early 1980s preceded the greatest diffusion of computer technology and the slowdown in the growth of workers' educational attainment. Use of computer technology does not appear to have a demand-side impact increasing the educational requirements of jobs. The slowdown in the growth of educational attainment is greatest in the late 1980s and 1990s, when inequality growth moderated or remained relatively flat, casting doubt on the supply-side case for a widening skills gap causing inequality growth.

Though the occupational composition shifted in favor of more-skilled workers during the period of inequality growth, this is true for previous decades as well, when inequality did not grow dramatically, and there is no evidence of any acceleration in the skill trend. There are few examples of disproportionate growth or decline in occupations likely to be sensitive to technological change. Direct measures of job skill requirements also indicate a shift toward more skilled jobs, but the trend is a steady, secular one, unlike the sharp growth of inequality in the early 1980s.

In short, it is hard to find evidence that information technology has done much to alter either the skill content of work within occupations or the occupational composition of the workforce, leaving the demand-side explanation with little support. Inequality growth does not seem to reflect the growth of a skills gap owing to either a slowdown in the growth of supply or an acceleration in demand and it is hard to find evidence that computers or information technology have done much to alter either the skill content of work within occupations or the occupational composition of the workforce.

The most powerful factors affecting wages would seem to be the recession and trade deficits of the early 1980s, which coincided with the most dramatic growth in wage inequality and the most noticeable change in occupational composition: the sharp decline in blue-collar manufacturing workers. The modest decline in inequality during the expansion of the 1990s also suggests the importance of macroeconomic forces. It appears that the skill requirements of postindustrial technology have had far less influence on wages than the state of the overall macroeconomy.

The clearest policy implication of this research is the need to maintain growth and low unemployment. The least affluent workers bear most of the burdens of recessions, and severe shocks, such as the deep recession of the early 1980s, have the power to reshape the wage structure. When the structure is changed, relative wage losses for those in the lower part of the distribution are not reversed when the business cycle turns upward; they persist for decades. Government can perform its greatest service to workers by maintaining tight labor markets and avoiding policies that are sharply recessionary. In addition, government can support wages at the lower end of the distribution with policies to reverse the decline of institutional protections that have continued since the economic crisis of the early 1980s. Such policies include maintaining the real value of the minimum wage and supporting protections for unions that preserve some balance between the bargaining power of workers and management.

Note

[1] The material in this policy brief is drawn from two working papers in which more detailed descriptions of data, methods, and results may be found (see Handel 2000a, 2000b).

References

Autor, David H., Lawrence F. Katz, and Alan B. Krueger.1998. "Computing Inequality: Have Computers Changed the Labor Market?" *Quarterly Journal of Economics* 113: 1169–1213.

Berg, Ivar. 1971. *Education and Jobs: The Great Training Robbery*. Boston: Beacon Press.

Bluestone, Barry, and Bennett Harrison.1983. *The Deindustrialization of America*. New York: Basic Books.

Danziger, Sheldon, and Peter Gottschalk. 1995. *America Unequal*. Cambridge, Mass.: Harvard University Press.

DiNardo, John E.,and Jörn-Steffen Pischke. 1997. "The Returns to Computer Use Revisited: Have Pencils Changed the Wage Structure, Too?" *Quarterly Journal of Economics* 112:290–303.

Freeman, Richard B. 1976. *The Overeducated American*. New York: Academic Press.

Handel, Michael J. 1999. "Computers and the Wage Structure." Working Paper no. 285. Annandale-on-Hudson,N.Y.: The Jerome Levy Economics Institute.

————. 2000a."Is There a Skills Crisis? Trends in Job Skill Requirements, Technology, and Wage Inequality in the United States." Working Paper no. 295. Annandale-on-Hudson, N.Y.: The Jerome Levy Economics Institute.

————.2000b. "Trends in Direct Measures of Job Skill Requirements." Working Paper no. 301. Annandale-on-Hudson, N.Y.: The Jerome Levy Economics Institute.

Harrison, Bennett,and Barry Bluestone. 1988. *The Great U-Turn: Corporate Restructuring and the Polarizing of America*. New York: Basic Books.

Katz, Lawrence F., and Kevin M. Murphy. 1992. "Changes in Relative Wages,1963–1987: Supply and Demand Factors."*Quarterly Journal of Economics* 107: 35–78.

Krueger, Alan B. 1993."How Computers Have Changed the Wage Structure: Evidence from Microdata, 1984–1989." *Quarterly Journal of Economics* 108: 33–61.

Mishel, Lawrence,and Jared Bernstein.1994. *Is the Technology Black Box Empty?: An Empirical Examination of the Impact of Technology on Wage Inequality and the Employment Structure*. Washington, D.C.:Economic Policy Institute.

Mishel,Lawrence, Jared Bernstein,and John Schmitt. 1997. *Did Technology Have Any Effect on the Growth of Wage Inequality in the 1980s and 1990s?* Washington, D.C.: Economic Policy Institute.

U.S. Department of Health, Education, and Welfare. 1973. *Work in America*. Cambridge, Mass.: MIT Press.

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Michael J. Handel is an assistant professor of sociology at the University of Wisconsin, Madison, and a research associate at the Levy Institute. His research interests include the growth of wage inequality in the United States over the last 20 years and its relationship to changes in technology, skills, work roles, organizational structure, and labor market institutions. His most recent work examines whether the diffusion of computers has induced a mismatch between the skills employers demand and those workers possess, the effect of workplace participation practices on workers' wages, and restructuring of management and supervisory layers in organizations. Handel received a Ph.D. in sociology from Harvard University.

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