



“Summary of article by David H. Autor, Lawrence F. Katz, and Alan B. Krueger: Computing Inequality: Have Computers Changed the Labor Market?” in Frontier Issues in Economic Thought, Volume 4: The Changing Nature of Work. Island Press: Washington DC, 1998. pp. 161-164

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The cause of rising income inequality in the United States has been the subject of debate among economists, as well as the general public. Some analysts favor an explanation based on globalization and international trade, in which low-skilled production workers are replaced by imports or outsourcing. Others argue that the decline of equalizing institutions, such as the weakening of unions or the falling real value of the minimum wage, is to blame.

This paper argues for a third explanation, maintaining that technological change, in particular computerization, has raised the demand for better educated workers and thereby increased the pay gap based on education. Analysis of Census and other data for selected years from 1940 to 1995 shows that the demand for skilled labor did grow more rapidly after 1970 than before, and that educational and skill upgrading in the 1980s and early 1990s was closely correlated with computer use and research and development spending. The association of computers with increased skill levels is statistically robust; many different data sets and formulations point to similar answers. By some measures, the rise in computer use statistically “explains” 30 to 50 percent of the recent acceleration in the demand for skilled labor, which is more than is explained by trade.

TRENDS IN SUPPLY AND DEMAND

Despite the large increase in the relative supply of more educated workers, the college/high school wage differential has grown substantially since 1950. This implies that there has been a large increase in demand for educated workers -- and that workers with different levels of education are not perfect substitutes for each other in production. Analyzing data separately for each decade leads to some minor puzzles, particularly in interpretation of the 1970s; thus there is some ambiguity about the starting point for recent labor market changes. However, over a longer period of time it is clear that the relative demand for educated labor was greater in the 1980s than in the 1960s or earlier.

The widespread adoption of computers is a prime suspect for a recent technological change that could lead to major changes in the demand for skills. Data is available on the percentage of U.S. workers who used a computer keyboard in 1984, 1989, and 1993; the overall figure grew from one-quarter of the workforce in 1984 to almost one-half in 1993. The occupational and demographic groups that experienced the greatest increases in computer use -- women, the better-educated, whites, white-collar workers, and full-time workers -- also experienced faster

than average wage gains. The wage premium associated with using a computer is roughly 20 percent, and increased slightly over the decade. The wage premium for college graduates (compared to high school graduates) grew much faster among computer users than among non-computer users.

COMPUTERS AND SKILL UPGRADING

Most of the increase in employment and wages of college graduates since 1970 has occurred within individual industries, not as a result of interindustry shifts. Analysis of data on nearly 200 detailed industries shows that the growth of computer use in an industry is associated with increased employment of college graduates and decreased employment of high school graduates, as a percentage of the industry's workforce. The effect of computers on the employment of high school dropouts is ambiguous, but there are few dropouts employed in high-technology industries in any case.

Did the increased employment of college-educated workers in industries that used computers simply reflect an ongoing trend toward higher skill levels in these industries? That is, were the same industries upgrading their workforces equally rapidly before and after the introduction of computers? To test this possibility, the increase in each industry's employment of college-educated workers in the 1960s, 1970s, 1980s, and early 1990s was separately compared to the industry's change in computer use from 1984 to 1993. Skill upgrading in the 1960s was only weakly related to later computer use; skill upgrading in the 1970s and later periods was more strongly related to rates of computerization. The increase in computer use statistically "explains" about half of the increase from the 1960s to the 1980s in the share of employment and payroll going to college-educated workers.

CAPITAL INTENSITY, R&D, AND COMPUTERS

Does the association between computer usage and educational upgrading reflect the specific nature of computers, or could it be a consequence of increased capital-intensity (and complementarity between capital and skilled labor) in general? Again, an empirical analysis confirms the importance of computers in particular. Data on capital intensity, and on several measures of computer investments and other high-technology spending, are available for a group of industries (somewhat more aggregated than the ones used in the previous tests). There is a strong association between an industry's computer capital per worker and its rate of educational upgrading of its labor force; this association is not substantially affected when the analysis includes controls for changes in the industry's overall capital-labor ratio. The impacts of computer capital on skill upgrading are much stronger than those of other components of high-tech capital. However, the effect of total research and development spending on skill levels is significant and increasing, and appears to be nearly independent of the effect of computer use.

A similar analysis can be performed on a dataset for detailed manufacturing industries used by other researchers; while it has cruder measures of skill levels, it allows comparison of the effects of computer use and of outsourcing (the latter may be a rough measure of trade effects). Although simple analyses show both factors to be associated with increases in skill levels, the computer effect is much more robust than the outsourcing effect when additional variables are

included. The most complete versions of this analysis show that the growth in computer investments can explain roughly one-third of the acceleration in skill levels in manufacturing from the 1970s to the 1980s. On the other hand, changes in import penetration and outsourcing explain very little of the increase in the rate of skill upgrading.

In summary, numerous statistical measures and analyses confirm the association of computer usage with industry skill upgrading, and hence with the rising inequality of incomes. The association of labor market changes is stronger with computer usage than with many other proposed explanatory variables. By various measures, 30 to 50 percent of the labor force upgrading can be statistically “explained” by correlation with computer usage.

Although these conditional correlations of computer measures and the growth in the utilization of college workers ... may not reflect causal relationships, it is clear that whatever is driving increases in the rate of growth of demand for skilled labor over the past twenty-five years is concentrated in the most computer-intensive sectors of the U.S. economy. (33)