The Polarization of Job Opportunities in the U.S. Labor Market

Implications for Employment and Earnings

David Autor, MIT Department of Economics and National Bureau of Economic Research

April 2010
Introduction and summary

Between December 2007, when the U.S. housing and financial crises became the subject of daily news headlines, and March of 2010, the latest period for which data are available, the number of employed workers in the United States fell by 8.2 million, to 129.8 million from 138.0 million. In the same interval, the civilian unemployment rate nearly doubled, to 9.7 percent from 5.0 percent, while the employment-to-population ratio dropped to 58.6 percent—the lowest level seen in more than 25 years. Job losses of this magnitude cause enormous harm to workers, families, and communities.¹

A classic study by economists Lou Jacobson, Robert LaLonde, and Daniel Sullivan found that workers involuntary displaced by plant downsizings in Pennsylvania during the severe recession of the early 1980s suffered annual earnings losses averaging 25 percent, even six years following displacement.² The nonpecuniary consequences of job losses due to the Great Recession may be just as severe. Studying the same group of workers with the benefit of 15 more years of data, labor economists Daniel Sullivan and co-author Till Von Wachter³ show that involuntarily job displacement approximately doubled the short-term mortality rates of those displaced and reduced their life expectancy on average by one to one and a half years. Thus, long after the U.S. unemployment rate recedes into single digits, the costs of the Great Recession will endure.

Despite the extremely adverse U.S. employment situation in 2010, history suggests that employment will eventually return and unemployment will eventually subside. But the key challenges facing the U.S. labor market—almost all of which were evident prior to the Great Recession—will surely endure. These challenges are two-fold. The first is that for some decades now, the U.S. labor market has experienced increased demand for skilled workers. During times like the 1950s and 1960s, a rising level of educational attainment kept up with this rising demand for skill. But since the late 1970s and early 1980s, the rise in U.S. education levels has not kept up with the rising demand for skilled workers, and the slowdown in educational attainment has been particularly severe for males. The result has been a sharp rise in the inequality of wages.

A second, equally significant challenge is that the structure of job opportunities in the United States has sharply polarized over the past two decades, with expanding job opportunities in both high-skill, high-wage occupations and low-skill, low-wage occupations, coupled with contracting opportunities in middle-wage, middle-skill white-collar and blue-collar jobs. Concretely, employment and earnings are rising in both high-education professional, technical, and managerial occupations and, since the late 1980s, in low-education food service, personal care, and protective service occupations. Conversely, job opportunities are declining in both middle-skill, white-collar clerical, administrative, and sales occupations and in middle-skill, blue-collar production, craft, and operative occupations. The decline in middle-skill jobs has been detrimental to the earnings and labor force participation rates of workers without a four-year college education, and differentially so for males, who are increasingly concentrated in low-paying service occupations.
This paper analyzes the state of the U.S. labor market over the past three decades to inform policymaking on two fronts. The first is to rigorously document and place in historical and international context the trajectory of the U.S. labor market, focusing on the evolving earnings, employment rates, and labor market opportunities for workers with low, moderate, and high levels of education. The second is to illuminate the key forces shaping this trajectory, including:

- The slowing rate of four-year college degree attainment among young adults, particularly males
- Shifts in the gender and racial composition of the workforce
- Changes in technology, international trade, and the international offshoring of jobs, which affect job opportunities and skill demands
- Changes in U.S. labor market institutions affecting wage setting, including labor unions and minimum wage legislation

The causes and consequences of these trends in U.S. employment patterns are explored in detail below, but the main conclusions can be summarized as follows:

- Employment growth is polarizing, with job opportunities concentrated in relatively high-skill, high-wage jobs and low-skill, low-wage jobs.

Secular shifts in labor demand have led to a pronounced “polarization” of job opportunities across occupations, with employment growth concentrated in relatively high-skill, high-wage and in low-skill, low-wage jobs—at the expense of “middle-skill” jobs. This polarization is depicted in Figure 1, which plots the change in the share of U.S. employment in each of the last three decades for 326 detailed occupations encompassing all of U.S. employment.4

These occupations are ranked on the x-axis by skill level from lowest to highest, where an occupation’s skill level (or, more accurately, its skill rank) is approximated by the average wage of workers in the occupation in 1980.5 The y-axis of the figure corresponds to the change in employment at each occupational percentile as a share of total U.S. employment during the decade. Since the sum of shares must equal one in each decade, the change in these shares across decades must total zero. Consequently, the figure measures the growth in each occupation’s employment relative to the whole.

This figure reveals a “twisting” of the distribution of employment across occupations over three decades, which becomes more pronounced in each period. During the 1980s (1979 to 1989), employment growth by occupation was almost uniformly rising in occupational skill; occupations below the median skill level declined as a share of employment, while occupations above the median increased. In the subsequent decade, this uniformly rising pattern gave way to a distinct pattern of polarization. Relative employment growth was

- Less widely discussed is that the rise in the relative earnings of college graduates are due both to rising real earnings for college workers and falling real earnings for noncollege workers—particularly noncollege males.
- Gains in educational attainment have not generally kept pace with rising educational returns, particularly for males. And the slowing pace of educational attainment has contributed to the rising college versus high school earnings gap.

While these points are fleshed out in the body of the paper, I briefly unpack each of them here.

Employment growth is “polarizing” into relatively high-skill, high-wage jobs and low-skill, low-wage jobs

Secular shifts in labor demand have led to a pronounced “polarization” of job opportunities across occupations, with employment growth concentrated in relatively high-skill, high-wage and in low-skill, low-wage jobs—at the expense of “middle-skill” jobs. This polarization is depicted in Figure 1, which plots the change in the share of U.S. employment in each of the last three decades for 326 detailed occupations encompassing all of U.S. employment.4

These occupations are ranked on the x-axis by skill level from lowest to highest, where an occupation’s skill level (or, more accurately, its skill rank) is approximated by the average wage of workers in the occupation in 1980.5 The y-axis of the figure corresponds to the change in employment at each occupational percentile as a share of total U.S. employment during the decade. Since the sum of shares must equal one in each decade, the change in these shares across decades must total zero. Consequently, the figure measures the growth in each occupation’s employment relative to the whole.

This figure reveals a “twisting” of the distribution of employment across occupations over three decades, which becomes more pronounced in each period. During the 1980s (1979 to 1989), employment growth by occupation was almost uniformly rising in occupational skill; occupations below the median skill level declined as a share of employment, while occupations above the median increased. In the subsequent decade, this uniformly rising pattern gave way to a distinct pattern of polarization. Relative employment growth was
most rapid at high percentiles, but it was also modestly positive at low percentiles (10th percentile and down) and modestly negative at intermediate percentiles.

Fast forward to the period 1999 to 2007. In this interval, the growth of low-skill jobs comes to dominate the figure. Employment growth in this period was heavily concentrated among the lowest three deciles of occupations. In deciles four through nine, growth in employment shares was negative. In the highest decile of occupations, employment shares were flat. Thus, the disproportionate growth of low-education, low-wage occupations becomes evident in the 1990s and accelerates thereafter.

Notably, this pattern of employment polarization has a counterpart in wage growth. This may be seen in Figure 2, which plots changes in real hourly wages relative to the median for all U.S. workers over two time periods: 1974 to 1988 and 1988 to 2006. In the 1974 through 1988 period, wage growth was consistently increasing in wage percentile; wages at percentiles above the median rose relative to the median while wages below the median fell. From 1988 forward, however, the pattern was U-shaped. Wages both above and below the median rose relative to the median.

In short, wage gains in the middle of the distribution were smaller than wage gains at either the upper or lower reaches of the wage distribution. This simultaneous polarization of U.S. employment and wage growth suggests an important theme, explored in detail below—labor demand appears to be rising for both high-skill, high-wage jobs and for traditionally low-skill, low-wage jobs.

**Employment polarization is widespread across industrialized economies**

The polarization of employment across occupations is not unique to the United States, but rather is widespread across industrialized economies. Evidence of this fact is presented...
below through a comparison of the change in the share of employment between 1993 and 2006 in 16 European Union economies within three broad sets of occupations—low, middle, and high wage—covering all nonagricultural employment and grouped according to average wage level.7

This comparison reveals that in all 16 countries, middle-wage occupations declined as a share of employment during this 13-year period. Simultaneously, low-wage occupations increased as a share of employment in 11 of 16 countries, while high-wage occupations increased in 13 of 16 counties. Notably, in all 16 countries, low-wage occupations increased in size relative to middle-wage occupations.

The comparability of these occupational shifts across a large set of developed countries—the United States among them—makes it likely that a common set of forces contributes to these shared labor-market developments. Simultaneously, the substantial differences among countries apparent in the data underscores that no single factor or common cause explains the diversity of experiences across the United States and the European Union.

The Great Recession has quantitatively but not qualitatively changed the direction of the U.S. labor market

The four major U.S. labor market developments referenced above and documented below—the polarization of job growth across high- and low-skill occupations, rising wages for highly educated workers, falling wages for less-educated workers, and lagging labor market gains for males—all predate the Great Recession. But the available data suggest that the Great Recession has reinforced these trends rather than reversing or redirecting them. In particular, job and earnings losses during the recession have been greater for low-education males than low-education females, and these losses have been most concentrated in middle-skill jobs. Indeed, there was essentially no net change in total employment in both high-skill professional, managerial and technical occupations and in low-skill service occupations between 2007 and 2009. Conversely, employment fell by 8 percent in white-collar sales, office, and administrative jobs and by 16 percent in blue-collar production, craft, repair, and operative jobs.

Key contributors to job polarization are the automation of routine work and the international integration of labor markets

Measuring employment polarization is easier than determining its root causes, but researchers are making progress in understanding the operative forces behind the data. A leading explanation focuses on the consequences of ongoing automation and offshoring of middle-skilled “routine” tasks that were formerly performed primarily by workers with moderate education (a high school diploma but less than a four-year college degree). Routine tasks as described by economists David Autor, Frank Levy, and Richard Murnane are job activities that are sufficiently well defined that they can be carried out successfully by either a computer executing a program or, alternatively, by a comparatively less-educated worker in a developing country who carries out the task with minimal discretion.8

Routine tasks are characteristic of many middle-skilled cognitive and production activities, such as bookkeeping, clerical work, and repetitive production tasks. The core job tasks of these occupations in many cases follow precise, well-understood procedures. Consequently, as computer and communication technologies improve in quality and decline in price, these routine tasks are increasingly codified in computer software and performed by machines or, alternatively, sent electronically to foreign worksites to be performed by comparatively low-wage workers.

This process raises relative demand for nonroutine tasks in which workers hold a comparative advantage. As detailed below, these nonroutine tasks can be roughly subdivided into two major categories: abstract tasks and manual tasks. These tasks lie at opposite ends of the occupational-skill distribution.

Abstract tasks require problem solving, intuition, and persuasion. Workers who are most adept in these tasks typically have high levels of education and analytical capability. Manual tasks, by contrast, require situational adaptability, visual and language recognition, and in-person interactions. Examples of workers engaged in these tasks include janitors and cleaners, home health aides, construction laborers, security personnel, and motor vehicle operators. Manual tasks demand workers who are physically adept and, in some cases, able to communicate fluently in spoken lan-
guage. Yet they appear to require little in the way of formal education, at least relative to a setting where most workers have completed high school.

In brief, the displacement of jobs—and, more broadly, occupations—that are intensive in routine tasks contributes to the polarization of employment into relatively high-skill, high-wage and low-skill, low-wage jobs, with a concomitant decline in middle-skill jobs.

Technology, trade, and offshoring are not by any means the only potential explanation for employment polarization—not is it necessarily the case that any one explanation accounts for the entirety of the phenomenon. Another frequently discussed explanation for the changing structure of employment and earnings in the U.S. focuses on shifts in labor market institutions, in particular, declining labor union penetration and a falling real minimum wage. There is little doubt that labor unions and the minimum wage contribute to changing employment and wage patterns, but it appears unlikely their role is paramount.

In the case of labor unions, their impact is largely confined to manufacturing and public sector employment, neither of which comprises a sufficiently large share of the aggregate economy to explain the overall polarization phenomenon. Moreover, polarization of employment into high-skill, high-wage and low-skill, low-wage jobs occurs across all sectors of the U.S. economy and is not confined to union-intensive manufacturing industries. This makes it unlikely that de-unionization or the decline in middle-wage contribute to changing employment and wage patterns, but it appears unlikely their role is paramount.

Nevertheless, the loss of middle-skill, blue-collar jobs in manufacturing—many at unionized firms paying relatively high wages—has likely been particularly harmful to the employment and earnings of less-educated males. The job opportunities available to males displaced from manufacturing jobs, particularly those displaced at midcareer, are likely to be primarily found in lower-paying service occupations. While these job losses may be primarily attributable to automation of routine production work and growing international competition in manufactured goods rather than to de-unionization per se, the magnitude of the income losses for males is surely magnified by the fact that the job losses are in union-intensive industries.

An often-discussed explanation for changes in the structure of U.S. wages and employment is the federal minimum wage. The minimum wage can affect wage inequality by boosting (or failing to boost) wages in low-paying jobs. But changes in the federal minimum wage over the last several decades appear an unlikely candidate for explaining the polarization of employment—that is, the growth of both low- and high-skill jobs—particularly because the timing of this explanation does not fit the main polarization facts. The federal minimum wage declined sharply in real terms (after adjusting for inflation) during the 1980s, which might in theory have led to a rise in low-skill, low-wage employment. Yet, as shown in Figure 1, the opposite occurred. From the late 1980s forward, the real federal minimum wage stabilized and then subsequently rose. We might therefore have expected low-skill employment to stagnate or decline. Instead, it grew rapidly.

The earnings of college-educated workers relative to high school-educated workers have risen steadily for almost three decades

After three decades of sustained increases, the return to skills as typically measured by the earnings ratio of college graduates relative to high school graduates is at a historic high. In 1963, the hourly wage of the typical college graduate was approximately 1.5 times the hourly wage of the typical high school graduate. By 2009, this ratio stood at 1.95. The entirety of this 45 percentage point rise occurred after 1980. In fact, the college-to-high-school earnings ratio declined by 10 percentage points in the 1970s.

Moreover, this simple comparison of the wage gap between college and high school graduates probably understates significantly the real growth in compensation for college graduates relative to high school graduates in recent decades. College graduates work more hours per week and more weeks per year than high school graduates, spend less time unemployed, and receive a disproportionate share of nonwage fringe benefits, including sick and vacation pay, employer-paid health insurance, pension contributions, and safe and pleasant working conditions. And these gaps in nonwage benefits between high- and low-education workers have each grown over the past several decades.
One important proximate cause for the rising relative earnings of college graduates is the slowdown in the rate of entry of new college graduates into the U.S. labor market starting in the early 1980s. Although this slowdown is by no means the only cause of changes in U.S. employment and earnings patterns—and, moreover, a cause whose genesis is not entirely understood—it is nevertheless a critical and often overlooked factor.

**Rising relative earnings of college graduates are due both to rising real earnings for college workers and falling real earnings for noncollege workers—particularly noncollege males**

The high and rising wage premium that accompanies a college education conveys the positive economic news that educational investments offer a high wage return. But this trend also masks a discouraging truth: The rising relative earnings of college graduates are due not just to rising real earnings for college workers but also to falling real earnings for noncollege workers. Real hourly earnings of college-educated workers rose anywhere from 10 to 37 percent between 1979 and 2007, with the greatest gains among workers with a postbaccalaureate degree.

Simultaneously, real earnings of workers with high school or lower educational levels either stagnated or declined significantly. These declines were especially steep among males: 12 percent for high school graduates and 16 percent for high school dropouts. The picture is generally brighter for females, but there was essentially no real earnings growth among females without at least some college education over this three-decade interval.

Though it is sometimes asserted that the “real” earnings declines of less-educated workers are overstated because they do not account for the rising value of employer-provided in-kind benefits such as healthcare, careful analysis of representative, wage, and fringe benefits data conducted by U.S. Bureau of Labor Statistics economist Brooks Pierce refutes this notion. Net of fringe benefits, real compensation for low-skilled workers fell in the 1980s. Further, accounting for fringe benefits, total compensation for high-skilled workers rose by more than did wages, both in absolute terms and relative to compensation for low-skilled workers.11

**Gains in educational attainment have not generally kept pace with rising educational returns, particularly for males**

Given the steep rise in wages for college graduates relative to noncollege graduates over the past three decades, one might have anticipated a substantial rise in college attainment among young adults. Yet, the actual increase in four-year college attainment was fairly muted, particularly for males. Between 1970 and 2008, four-year college attainment among white male young adults ages 25 through 34 rose only modestly, from 20 percent in 1970 to 26 percent in 2008.12 Remarkably, among white females of the same age range, college attainment nearly tripled, to 34 percentage points from 12 percentage points. Thus, in three decades the white male-female gap in college attainment went from positive 8 to negative 8 percentage points!

Among young African-American adults, this picture is also mixed. The proportional gains in four-year college completion between 1970 and 2008 were substantially greater for blacks than for whites. Indeed, college completions rose more than two-fold among black males and more than three-fold among black females. Despite these gains, the levels of college completion for blacks remain substantially below that of whites. The black-white gap in college completion closed by only 2 percentage points among males in this period, and expanded by 6 percentage points among females.

The only ethnic category for which gains in educational attainment have been truly spectacular was “other nonwhites,” a category that includes many Asian Americans.13 In 2008, more than half of male and female young adults in this category had completed a four-year college degree. This is an increase since 1970 of 22 percentage points among males and 32 percentage points among females.

**Roadmap of the analysis**

The remainder of the paper is structured as follows. The next section provides further details on the polarization of U.S. employment, both for the labor market as a whole and as it has unfolded differentially among sex and education groups. This section then considers four major potential causes of polarization discussed briefly above: technological change,
trade and offshoring, de-unionization, and a falling minimum wage. The section that follows further documents that the polarization of employment is not unique to the U.S. but rather is widespread among European Union economies.

The paper then steps back from this detailed portrait of polarization to explore the overriding role of labor demand shifts in explaining the sharp changes in earnings and employment levels by education and sex. This section shows that the rising wages of college-educated workers relative to high school-educated workers can in large part be explained by a long-term, secular rise in the demand for college workers coupled with a sharp decline in the entry of new college workers in the U.S. labor market starting in the late 1970s. This section highlights that a major proximate cause of this slowdown is the sharp deceleration in the rate of college attainment among young males starting in the late 1970s, the reasons for which are only poorly understood.

The final section explores earnings by education level in greater detail to document that the simple college versus high school earnings dichotomy masks a highly consequential development: The rising demand for “education” appears to be limited to very high levels of education. Workers with less than a four-year college education, and particularly non-college males, experienced stagnant or in some cases declining earnings over the past three decades. I link these striking wage developments to the polarization of employment, arguing that declining opportunities in middle-skill jobs help to explain why wages are rising for highly educated workers whiles wages for middle- and low-educated workers are growing less rapidly and, moreover, converging toward one another. The paper then offers concluding observations.
Summary of findings

Despite the extremely adverse U.S. employment situation in 2010, history suggests that employment will eventually return and unemployment will subside. But two key challenges facing the U.S. labor market—both evident prior to the Great Recession—will endure.

The first is that for many decades, the United States has experienced increased demand for skilled workers. From the end of World War II to the mid-1970s, rising levels of educational attainment generally kept pace with this rising demand for skill. But since the mid-1970s, the rise in U.S. education levels has not kept up with the rising demand for skilled workers, with the slowdown in educational attainment particularly severe for males.

The result is a sharp rise in the inequality of wages over the past several decades. In 1980, workers with a four-year college degree earned about 50 percent more per hour than workers with a high school diploma. In 2008, they earned 95 percent more per hour.

The second challenge—and an important factor behind the rising earnings gap between college-educated and high school-educated workers— is that the structure of job opportunities in the United States has sharply polarized over the past two decades. Job opportunities are increasingly found in both high-skill, high-wage professional, technical, and managerial occupations and in low-skill, low-wage food service, personal care, and protective service occupations.

Conversely, job opportunities are declining in both middle-skill, white-collar clerical, administrative, and sales occupations and in middle-skill, blue-collar production, craft, and operative occupations. The decline in middle-skill jobs has been detrimental to the earnings and labor force participation rates of workers without a four-year college education, and differentially so for males, who are increasingly concentrated in low paying service occupations.

Fast facts

- U.S. employment growth is polarizing, with job opportunities increasingly concentrated in relatively high-skill, high-wage jobs and low-skill, low-wage jobs.
- Employment polarization is not a uniquely American phenomenon; it is widespread across industrialized economies.
- Key contributors to job polarization are the automation of routine work and, to a lesser extent, the international integration of labor markets through trade and, more recently, offshoring. The declining penetration of labor unions and the falling real value of the federal minimum wage have played a smaller role.
- The Great Recession quantitatively but not qualitatively changed the trend toward employment polarization in the U.S. labor market. Employment losses during the recent recession were far more severe in middle-skill white- and blue-collar jobs than in either high-skill, white-collar jobs or in low-skill service occupations.
- The earnings of college-educated workers relative to high school-educated workers have risen steadily for almost three decades.
- The rise in the relative earnings of college graduates is due both to rising real earnings for college-educated workers and falling real earnings for noncollege-educated workers, particularly noncollege-educated males.
- Gains in educational attainment have not generally kept pace with rising educational returns, particularly for males. And the slowing pace of educational attainment has contributed to the rising college/high school earnings gap.