Chapter 3

The Macroeconomy and Determinants of the Earnings of Less-Skilled Workers

Robert E. Hall

Poverty is a condition with multiple causes, but every analysis agrees on the importance of the earnings of less-skilled workers.[1] Macroeconomic—that is, economywide—influences determine average earnings. This chapter looks at data from the U.S. economy through the lens of macroeconomics. Some of the key questions I consider are: How much have wages in general risen over the past fifty years in terms of the value of what workers produce and what workers consume? How has productivity growth and rising stocks of plant and equipment contributed to wage growth in general? How have wages of workers at the bottom of the skill distribution (those who did not finish high school), in the middle (high school graduates with no college), and at the top (college graduates) changed over time? What has happened to the demand for workers in these skill groups? What has happened to the fraction of Americans living in poverty as wages have risen? What happens to workers in the various skill groups when employment falls sharply in a recession?

I break down the macroeconomic determinants of earnings into those that affect all workers and those that operate differently by education group. Economic analysis points to two fundamental factors that affect average wage growth—productivity growth and capital deepening, that is, the accumulation of additional plant and equipment per worker. Both have been important over the past fifty years. Productivity growth in the 1990s was lower than in almost any other period, but capital deepening added to wage growth and wages significantly outperformed the neoclassical benchmark, so total wage growth was impressive.

The American economy has been quite successful in raising the wages of its workers measured in terms of the products that the country produces. For two reasons, it has been less successful in raising wages in terms of what people consume. First, the United States is a major producer of capital goods, especially computers and software, and rapid productivity growth in this area has driven

down the prices of these products, which families consume in only small amounts. The services that account for a large part of consumption have become relatively more expensive. Second, the United States has suffered a long decline in its terms of trade with the rest of the world, partly resulting from increases in the price of oil. People consume imported products that have become gradually more expensive in relation to domestically produced products. The 1990s saw some relief from this trend, but it was substantial in the 1980s and resumed after 2000.

The real earnings of the least-skilled workers—here taken to be those who did not finish high school—rose by about 1.5 percent per year in the boom years of 1992 to 2000, after stagnating in the previous boom of 1982 to 1990. In addition to the factors that caused earnings in general to rise, this group enjoyed an unusual increase in demand associated with the expansion of industries, such as construction and auto repair, that hire large proportions of the least-educated. And the number of people in the United States who had not graduated from high school fell by 1.3 percent per year.

Stagnant earnings of low-skilled workers coincided with increases in the incidence of poverty in the 1980s, while improvements in their earnings in the 1990s coincided with modest declines in the incidence of poverty. A long-term trend toward higher educational attainment contributed to improvements in the distribution of income at all times. Nonetheless, poverty was just as frequent in 2003 as it was in 1975. Factors that may account for the difference are outside the province of macroeconomics; they include increases in the dispersion of earnings within skill groups and the growing tendency for individuals to live by themselves, sacrificing the economies of living in larger households.

The business cycle is an important and enduring feature of the macroeconomy. Measured in terms of output, the cycle comprises a sharp and brief contraction followed by a long period of expansion. Usually output growth is highest just after the contraction, as the economy rebounds from the shock that caused the recession in the first place. Over U.S. history, recessions have occurred about twice a decade, but the frequency has been once a decade over the past thirty years. In the labor market, employment falls and unemployment rises during a contraction. In the past two recessions, 1990 to 1991 and 2001, employment growth lagged behind output growth in the first two years of the recovery. The labor market remained soft for several years following these recessions. Although recessions do not have strong effects on wages earned per hour of work, they have sharp downward effects on earnings, because employment falls and the hours of work of the employed also fall. Recessions have uneven effects across the economy—employment falls sharply in manufacturing, especially in capital goods, autos, and other durables. In past recessions, employment fell in construction as well, but the recession of 2001 was unique in avoiding this consequence. The industries that contract in recessions generally employ lower-skilled workers, so recessions result in rising poverty. Because the 2001 recession did not include a contraction of construction employment and because construction

is particularly intensive in its use of low-skilled workers, the recession did not have as large an adverse effect on poverty as did earlier recessions.

This chapter does not attempt to survey the research by microeconomic specialists on related topics. The other chapters in this volume, especially those by David Card and John DiNardo and by Rebecca Blank, provide many references. I concentrate here on earnings before income taxes and transfers. The effects of changes in tax rates, changes in the Earned Income Tax Credit (EITC), and welfare reform are beyond my scope.

PRODUCT WAGES

I start this section by describing a simple model of production and wages that sees wide use in economics as a benchmark. Because the model bears the name "neoclassical," I refer to calculations from the model as the "neoclassical benchmark." The neoclassical economy has competitive labor and product markets and a simple technology. I explain later how departures from these and other properties may explain the actual performance of wages.

Robert Solow (1956) developed the neoclassical model in the form I use here. The economy has a single production function,

$$Y_t = A_t F(L_t, K_t). \tag{3.1}$$

Here A_t is an index of total factor productivity. The index can be calculated from data on output, Y_t, labor, L_t, and capital, K_t, according to a robust procedure from Solow (1957). When productivity enters in the form shown in this equation—multiplying the total contribution of all of the factors of production—it is said to be "Hicks-neutral."

If firms hire in a competitive labor market at wage w_t and sell their output in a competitive product market at price p_t, then they adjust their capital-labor ratio to satisfy

$$\frac{w_t}{p_t} = A_t \frac{\partial F(L_t, K_t)}{\partial L}. \tag{3.2}$$

This equation states the equality of the wage and the marginal product of labor. The left side is the *product wage*, the ratio of the wage paid to the price received. It differs from the *real wage*, which is the wage received by workers divided by the cost of living. The product wage includes capital goods, such as computers and software, whose prices have declined relative to consumption goods prices. Further, workers consume imported goods and the United States produces exported goods, so changes in the relative price of imports to exports cause the product wage to move differently from the real wage. The relative price is called the *terms of trade*. A conspicuous manifestation of this phenomenon in the United

States is the decline in real wages when oil prices rise. In principle, oil prices have no direct effect on the product wage. Many other factors, including the declining relative price of capital goods (a major component of U.S. exports), have contributed to the worsening of the terms of trade since the mid-1980s.

In the special case of Cobb-Douglas technology, the production function is

$$Y_t = A_t L_t^{\alpha} K_t^{1-\alpha}, \tag{3.3}$$

where α is the elasticity of output with respect to labor input, assumed to be a constant. The marginal product of labor is

$$A_t \frac{\partial F(L_t, K_t)}{\partial L} = A_t \alpha \left(\frac{K_t}{L_t} \right)^{1-\alpha}. \tag{3.4}$$

In this case, the product wage is

$$\frac{w_t}{p_t} = A_t \alpha \left(\frac{K_t}{L_t} \right)^{1-\alpha}. \tag{3.5}$$

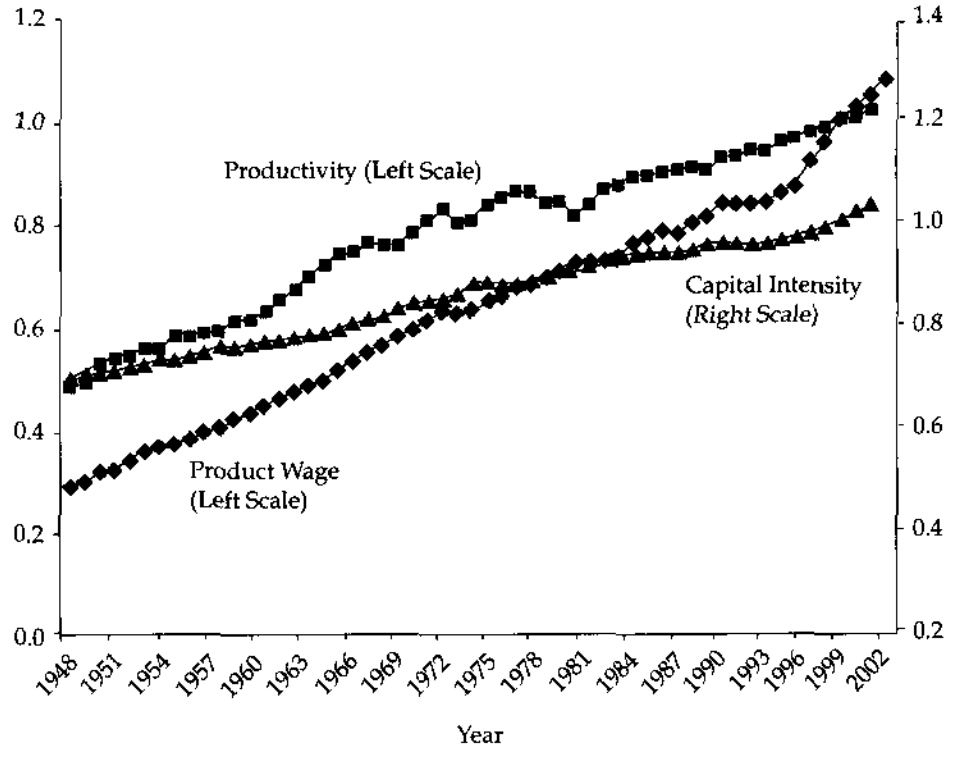
This equation shows that the product wage has only two determinants—productivity A_t and the capital-labor ratio K_t/L_t.

If the measured real wage departs from this simple relation, the cause is some combination of the following factors:

- Markets are not competitive, so changes in market power result in changes in the product wage.
- Technical change is not Hicks-neutral but is biased toward capital or labor.
- The elasticity, α, is not a constant.
- The elasticity of substitution is not one, as in Cobb-Douglas, but is greater than or less than one.
- There are errors in the data.

With respect to the first entry in the list, I should say some more about how I am using the term "competition." If competition in product markets is limited, firms are charging prices that exceed marginal cost—market power boosts the price above the perfectly competitive level. Higher product prices result in lower product or real wages—purchasing power that would flow to workers in a competitive economy is diverted to the owners of firms with market power. I am distinguishing product-market competition from another type of competition, in the context of the global economy, where foreign producers may shift the terms of trade adversely, resulting in a decline in the real wage. I take account of this type of competition through the calculation of real wages, which includes the terms-of-trade effect.

FIGURE 3.1 / Product Wage and Determinants, 1948 to 2003

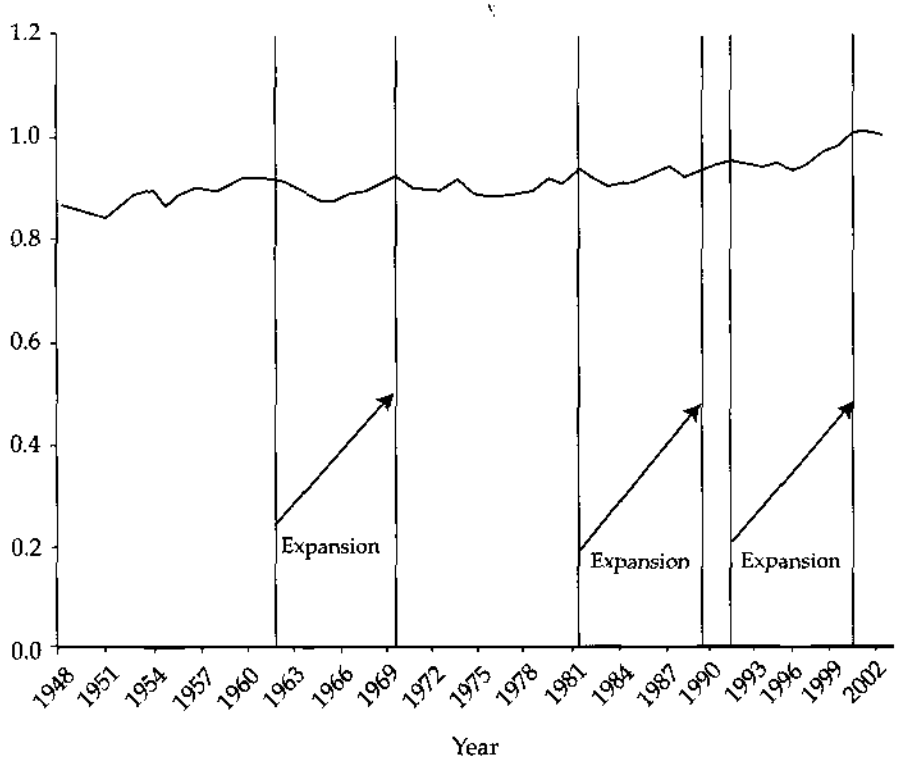


Sources: Author's compilation. Productivity: From Bureau of Labor Statistics, "Multifactor Productivity," http://www.bls.gov/mfp/home.htm. Capital intensity: Capital services index from above source divided by labor hours, same source. Product wage: Hourly compensation from BLS, "Productivity and Costs," http://www.bls.gov/lpc/home.htm, divided by GDP deflator, same source.

The measure of wages I study here and throughout the chapter is comprehensive—it counts all of the economic value that a worker receives from an employer. In particular, wages include the value of fringe benefits. Discussions of wages that omit fringes are seriously misleading, because fringes—mainly the value of retirement benefits and health insurance—grow at variable rates but usually faster than cash wages.

Figure 3.1 shows the hourly product wage for all private workers in the U.S. economy, as calculated by the Bureau of Labor Statistics, with adjustments for the age, education, and sex composition of employed workers. The nominal wage is divided by the price index for GDP. The product wage has risen consistently over the past sixty years—the only important interruption occurred in the early 1990s.

FIGURE 3.2 / Product Wage as Ratio to Neoclassical Benchmark



Source: Author's compilation.
Notes: Product wage from figure 3.1. Benchmark: Productivity from figure 3.1 divided by capital intensity raised to the power 0.3 (corresponding to $\alpha = 0.7$).

Figure 3.1 shows that both productivity and capital deepening have been sources of product wage growth over the period. I should note that capital deepening is not really an independent factor in the longer run. An economy cannot continue raising its capital-labor ratio unless productivity increases provide the necessary resources. But in the shorter run, productivity and capital deepening can move separately.

Productivity growth is not much associated with booms and recessions. In particular, productivity did not grow rapidly during the great boom of the 1990s. On the other hand, capital deepening tends to occur in the later periods of booms. Capital itself rises rapidly throughout a boom, but in the earlier phase, employment also rises rapidly, so the capital-labor ratio does not grow rapidly. After employment growth slows, investment continues and the capital-labor ratio grows more rapidly than average.

Figure 3.2 shows the product wage as a ratio to the neoclassical benchmark of

TABLE 3.1 / Annual Percentage Growth of Product Wage and Components of Benchmark

	Product Wage	Productivity	Capital Deepening	Benchmark	Wage Growth Relative to Benchmark
1948 to 2002	2.4	1.4	0.8	2.2	0.3
1962 to 1970	2.9	1.9	0.9	2.8	0.1
1982 to 1990	1.6	1.4	0.3	1.7	–0.1
1992 to 2000	2.2	0.9	0.5	1.5	0.7

Source: Author's compilation.
Notes: Product wage, productivity, and capital deepening are percentage growth rates for the data from figure 3.1. Benchmark and wage divided by benchmark are from figure 3.2.

equation 3.5. I calculate the neoclassical benchmark as the ratio of productivity from figure 3.1 to the capital intensity raised to the power 0.3, corresponding to $\alpha = 0.7$. If the wage tracked the benchmark perfectly, the figure would show a horizontal line at one. In fact, the line rises gradually over time, at about one-quarter of a percent per year. By the list I gave earlier, this means that market power has fallen slightly, that technical change is biased toward labor, that the elasticity of substitution is greater than one, or that there is a growing overstatement of the wage from mismeasurement. The only implausible member of this group is cumulative mismeasurement. Many observers believe that the U.S. economy is becoming more competitive. Estimates of the elasticity of substitution generally find values below one. But the magnitude of the trend in the discrepancy between the product wage and the benchmark is so small that it should not interfere with the analysis in this chapter.

The upward arrows in the figure mark the three great expansions of the second half of the twentieth century, 1962 to 1970, 1982 to 1990, and 1992 to 2000. In these expansions, the wage-benchmark ratio declined in the early years and rose in the later years. This behavior is consistent with models of lags in wage adjustment. In the expansion of the 1980s, the rise toward the end was small. The difference turns out to be critical for the experiences of all skill levels of workers—the 1980s were a disappointing period for wages, while the 1960s and 1990s saw substantial increases.

Table 3.1 summarizes the data on the product wage and the benchmark for the entire period and for the three major booms. All of the figures are average annual percentage growth rates. The product wage rose between 2 and 3 percent per year in all of the periods except the boom of the 1980s, when it grew 1.6 percent per year. Productivity rose about 1.4 percent per year on the average over the whole period, with the most rapid growth in the 1960s and the slowest in the 1990s. (Productivity has grown rapidly in the current decade—not shown separately in the table.) Capital deepening ran at 0.75 percent per year for the

whole period and ranged from 0.31 percent in the 1980s to 0.93 percent per year in the 1960s. Finally, wages beat the benchmark over the entire period and in the booms of the 1960s and 1990s and fell short by a slim margin in the 1980s. The 1990s were the standout among the three booms in terms of wage increases above the benchmark.

Note that the variations of wage growth around the benchmark are relatively small, both in absolute terms and in relation to the general amount of noise in the data. The unusual performance of the 1990s is far from statistically significant. Nonetheless, the cumulative extra wage growth of about 5 percent over the eight years of the 1990s boom is important for the topic of this chapter, because it was present in the wages of low- as well as high-skilled workers.

What are the lessons from the behavior of the product wage over the past fifty years? The product wage is the purchasing power of the wage in terms of the products that the United States makes. I find that it behaved much as the neoclassical model predicts. Wage growth depends primarily on productivity growth and secondarily on capital deepening. Because of rapid productivity growth and capital deepening, the product wage grew rapidly for the first half of the fifty-year period. The second half was more disappointing in both respects. The 1990s were a period of moderate productivity growth but fairly rapid product wage growth, because wages outperformed the neoclassical benchmark. The acceleration of productivity growth (not capital deepening) in recent years may raise the growth of the product wage during the current decade.

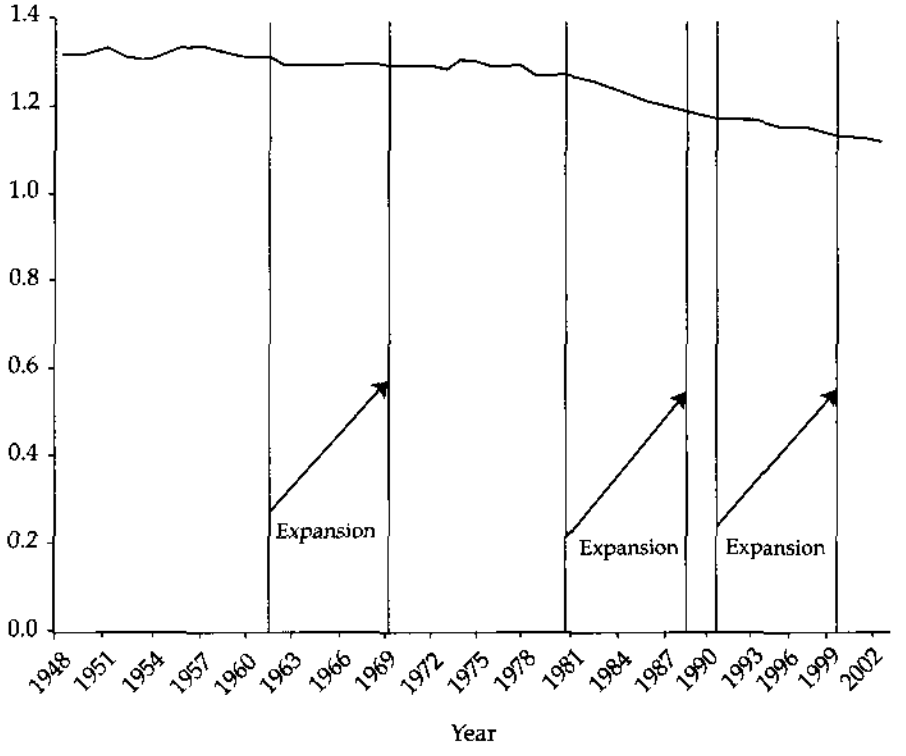
REAL WAGES

Now I turn to the real wage, the purchasing power that workers enjoy from their earnings. I have already mentioned that the real wage differs from the product wage because it focuses on the products that workers consume rather than the ones they produce. Going from the product wage to the real wage requires removing capital goods and exports and bringing imports into the picture. The real wage is not so much a measure of the performance of the U.S. economy as of the world economy. If an imported product such as oil becomes more expensive in the world market, the purchasing power of U.S. workers declines even though their productivity is not affected.

Real wages measure the claim over consumption goods that workers receive from their work. Measurement of real wages requires the economist to take a stand on some controversial issues. In principle, the real wage needs to take account of all of the ways that taxes reduce the actual amount of consumption that earnings can support. Taxes include excise, sales, and property taxes imposed on goods and services, payroll taxes, and income taxes. Further, programs, such as the Earned Income Tax Credit (EITC), that subsidize wages ought to be treated as factors that increase the real wage by extending purchasing power from earnings.

The situation is even more complicated for taxes that are directly related to

FIGURE 3.3 / Ratio of Prices, Private GDP to Consumption Goods and Services



Source: Author's compilation.
Notes: Consumer price deflator from National Income and Products Accounts (NIPA), table 1.1.4, http://www.bea.gov/bea/dn/nipaweb/. Table.asp?Selected = N; GDP deflator from figure 3.1.

programs that provide the taxpayer direct value. The leading example is the payroll tax for Social Security. Many workers receive Social Security benefits worth more than their payroll tax payments—this is most likely for low-wage workers whose benefits are in the progressive part of the benefit formula.

Untangling the tax factors that belong in a fully accurate measure of the real wage is beyond the scope of this chapter. I consider only the important difference between the product and the real wage that arises from capital goods, exports, and imports. This difference can be measured by the ratio of the price of GDP to the price of consumption goods. Figure 3.3 shows the data. The decline in the second half of the period indicates a time when the real wage was not rising as fast as the product wage. Although rising energy prices are one factor, by far the biggest is the rise in the price of consumption goods and services relative to the

TABLE 3.2 / Annual Average Percentage Growth in Real Wages

Period	Product *Wage*	GDP *Price*	Consumption *Price*	Difference in Price *Change*	Real *Wage*
1948 to 2002	2.4	3.2	3.5	0.3	2.1
1962 to 1970	2.9	2.6	2.7	0.1	2.8
1982 to 1990	1.6	2.8	3.7	0.9	0.7
1992 to 2000	2.2	1.5	1.9	0.4	1.8

Source: Author's compilation.
Notes: Product wage and GDP price from figure 3.1. Consumption price from figure 3.3. Real wage is product wage multiplied by the ratio of the GDP deflator to the consumption deflator.

price of investment goods. This rise became important in the 1980s, when computers and software became a substantial share of total investment. The terms-of-trade effect cut real wage growth by 0.309 percent per year for the whole period, by 0.10 in the 1960s boom, by 0.88 percent in the 1980s boom, and by 0.42 percent in the 1990s boom. These figures are shown in table 3.2 in the column headed "Difference in Price Change." Again, the effect of the adjustment is to enlarge the difference between the 1980s and the 1990s.

Table 3.2 shows real wage growth for the entire period from 1948 through 2002 and for the three major booms. Real wages grew the most in the 1960s, when the product wage grew rapidly from productivity growth and capital deepening and the terms-of-trade effect was essentially neutral. Real wages grew the least in the 1980s, when productivity grew a bit below average, capital deepening was minimal, and the terms of trade shifted quite adversely. In these episodes, wage movements relative to the benchmark were not an important factor. In the 1990s, productivity growth was at its lowest level, but capital deepening was greater, the terms of trade did not shift as adversely, and the product wage rose relative to the benchmark. As a result, the real wage rose by a full percentage point more per year in the 1990s than in the 1980s. Real wage growth was only a bit below average in the boom of the 1990s, despite poor productivity growth.

The examination of real wages shows that the product wage—earnings stated in terms of what workers produce—gives too optimistic a picture of the benefits that workers receive from the growth of the economy. The U.S. economy specializes in making products such as computers and other capital goods that are becoming cheaper, while the nation imports products such as oil that are becoming more expensive. The real wage gives a more realistic view of what workers actually gain in economic terms from their work. Real wage growth was rapid until the 1970s, slowed down abruptly in the 1970s and 1980s, and then resumed in the 1990s. Although rising oil prices in 2004 and 2005 inevitably cut into real wage growth, the effect has been small as of this writing—from the first quarter of 2004 through the second quarter of 2005, the prices of goods consumed, in-

cluding oil, rose only about three-quarters of a percentage point more than the prices of goods produced.

WAGES BY EDUCATION GROUP

The rest of the chapter studies wages and earnings by education group. Poverty is concentrated in the lowest-skilled group, those who have not graduated from high school. It is useful to compare the wages of the least-skilled to those in other skill groups. I consider three other groups—high school graduates, those who started college but did not receive a BA, and college graduates. My investigation starts by building measures of wages for the four groups that are reasonably comprehensive—they include the value of fringe benefits. As in the case of overall wages, the measures can be stated as product wages or as real wages. I compare product wages to a neoclassical benchmark. While overall wages track the benchmark reasonably well, wages by education group diverge conspicuously—wage growth among the least-educated has fallen far short of the benchmark. The actual real earnings of the most-educated, college graduates, rose rapidly. Real earnings of the least-educated fell during the 1980s but grew reasonably rapidly in the 1990s. For an extended review of these wage changes and the related literature, see Autor and Katz (1999).

To understand the differences in the experiences of the least-skilled in the two decades, I examine measures of the demand and supply for the four education groups. Demand rose rapidly for the two top groups. Demand fell sharply during the 1980s for the least-educated group but rose during the 1990s—hence the improvement in earnings. Some industries that employ significant fractions of the least-educated, notably construction, grew during the 1990s after shrinking during the 1980s. On the supply side, I find that the least-educated were helped by declining supply. This earnings decline from shrinking supply might have been somewhat offset by the tendency for the remaining less-educated population to be drawn from further down the skill distribution. The growth of real earnings for this group in the 1990s was the result of growing demand and shrinking supply.

In this investigation, I make use of a consistent tabulation of the March Current Population Survey on annual earnings by education group, 1975 through 2002. The CPS reports earnings in the sense of the amount reported on a worker's W-2 form. The concept of earnings appropriate for the analysis in this chapter includes not only cash earnings in the W-2 sense but also fringe benefits provided in kind, which are omitted from W-2s. The National Income and Products Accounts (NIPAs) make a serious attempt to include fringes in reported compensation, based on data provided by employers to the Internal Revenue Service (IRS) and on other information. I am not aware of any other comprehensive measure of the value of fringe benefits. The ratio of NIPA compensation to CPS compensation measures the extent of the extra element in compensation across all workers. It is not possible to break it down by education group. However,

there are reasons to believe that the ratio is not too different by education or earnings level. The biggest single element is the employer's contribution to Social Security, a fixed ratio up to the cutoff. With respect to other elements, some factors point to an increasing ratio of total compensation to CPS compensation—such as the fact that more education-intensive industries tend to have higher fringes—while others point in the opposite direction—such as the fact that nondiscrimination laws require employers, in some cases, to offer the same benefits packages to high- and low-wage workers.

To scale up to a more complete concept of earnings, I multiply all of the figures by the ratio of total compensation in the NIPAs (tables 6.2B and 6.2C) to the total reported for the CPS. This ratio was 1.13 in 1975, rose to 1.20 in 1992, and then declined back to 1.13 in 2002. Without this adjustment, the performance of earnings in the 1990s would appear to be even more favorable but would fail to agree with the highly reliable figures from the NIPAs.

The Cobb-Douglas benchmark model I discussed earlier extends easily to an economy with several kinds of labor. Let L_t be a particular category of labor, such as the lowest skill group. Let X_t be another input, such as another skill group. The production function becomes

$$Y_t = A_t L_t^{\alpha} X_t^{\beta} K_t^{1-\alpha-\beta}, \tag{3.6}$$

where now α is the elasticity of output with respect to unskilled labor input. The profit-maximizing condition becomes

$$\frac{w_t}{p_t} = A_t \alpha L_t^{\alpha-1} X_t^{\beta} K_t^{1-\alpha-\beta}. \tag{3.7}$$

Substitute in the expression for output, Y_t, to get

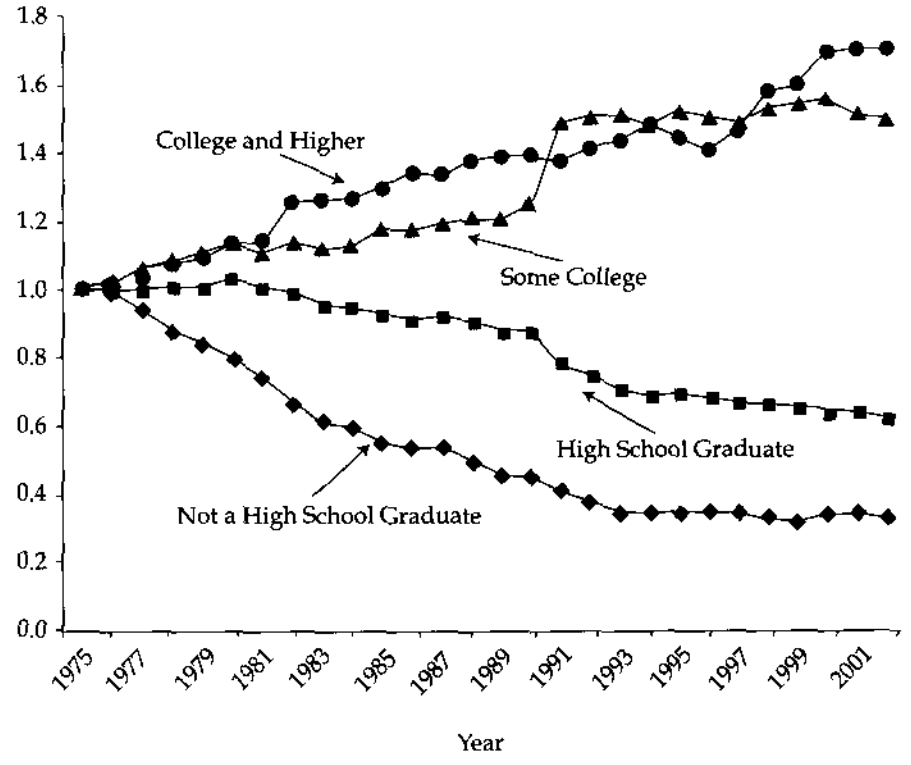
$$\frac{w_t}{p_t} = \alpha \frac{Y_t}{L_t}. \tag{3.8}$$

The product wage depends only on the output-labor ratio. Output stands in for both productivity and the capital stock in the earlier equation.

Figure 3.4 displays the ratio of the left side of equation 3.8 to the right side, stated as an index. This index is the ratio of the product wage to the prediction for the product wage given the level of output and the volume of employment for each of the four education categories. I measure the product wage as the average earnings of people with earnings, from the CPS, to the consumption deflator from the NIPA.

Figure 3.4 illustrates a point that has received enormous attention in recent years—the wages of less-skilled workers have grown far less than predicted by the Cobb-Douglas benchmark and the wages of the more-skilled have grown correspondingly faster. Often this finding is formulated in terms of skill-biased technical change. That is, one explanation is that technical progress does not take

FIGURE 3.4 / Ratio of Product Wage to Cobb-Douglas Benchmark



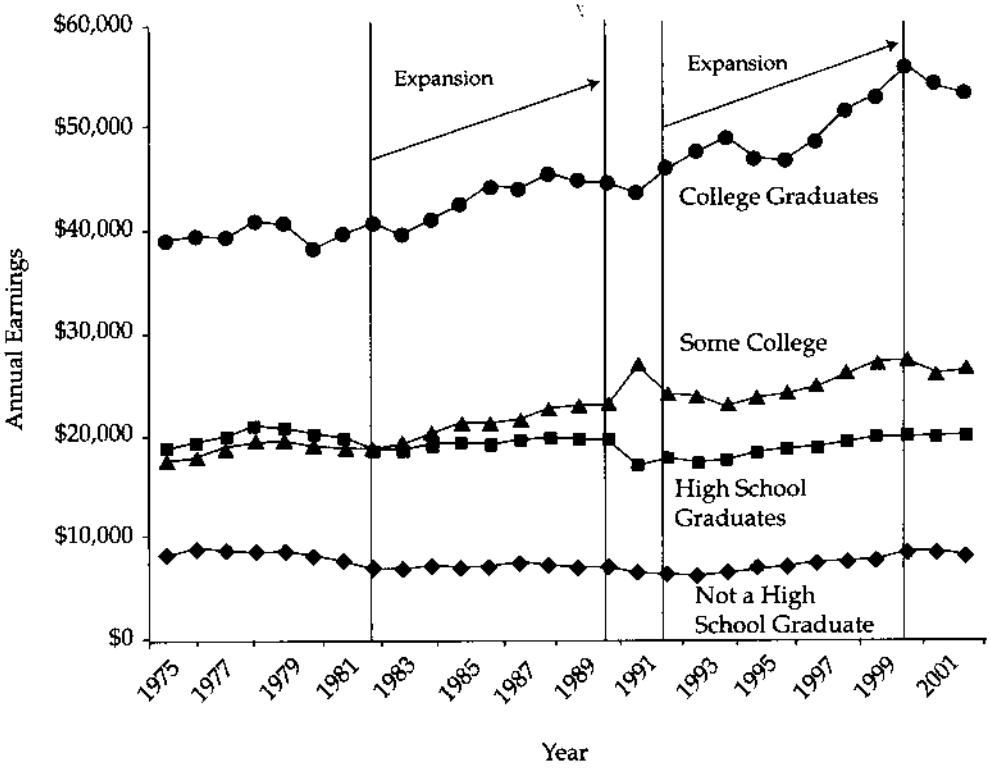
Source: Author's compilation.
Notes: Output is real GDP, NIPA, table 1.1.3. Employment is number of workers with earnings, CPS, http://www.census.gov/population/socdemo/education/tabA-3.xls. Nominal wage rate is average earnings per worker, same source. Adjustment for compensation is not included in the CPS: ratio of compensation in NIPA, table 6.2, to total compensation from the CPS (source above). Deflated by GDP deflator, NIPA, table 1.1.4.

the form in equation 3.8, where a single index amplifies the productivity of all inputs jointly, but rather each input is amplified by its own productivity index.

I turn now to data on real earnings. I study real earnings per person. Changes in this measure occur because of changes in wages, changes in labor force participation, and changes in annual hours of work per worker. The CPS reports total earnings for an education group and the number of people with any earnings.

Figure 3.5 shows the results of these calculations, presented as annual real earnings per person for each of the four education groups. The figure documents a familiar story—starting in the 1980s, the earnings of people with higher education have grown much faster than the earnings of those with a high school education or less. The figure also shows that earnings per person reached a low

FIGURE 3.5 / Real Annual Earnings per Person by Education, 1975 to 2002

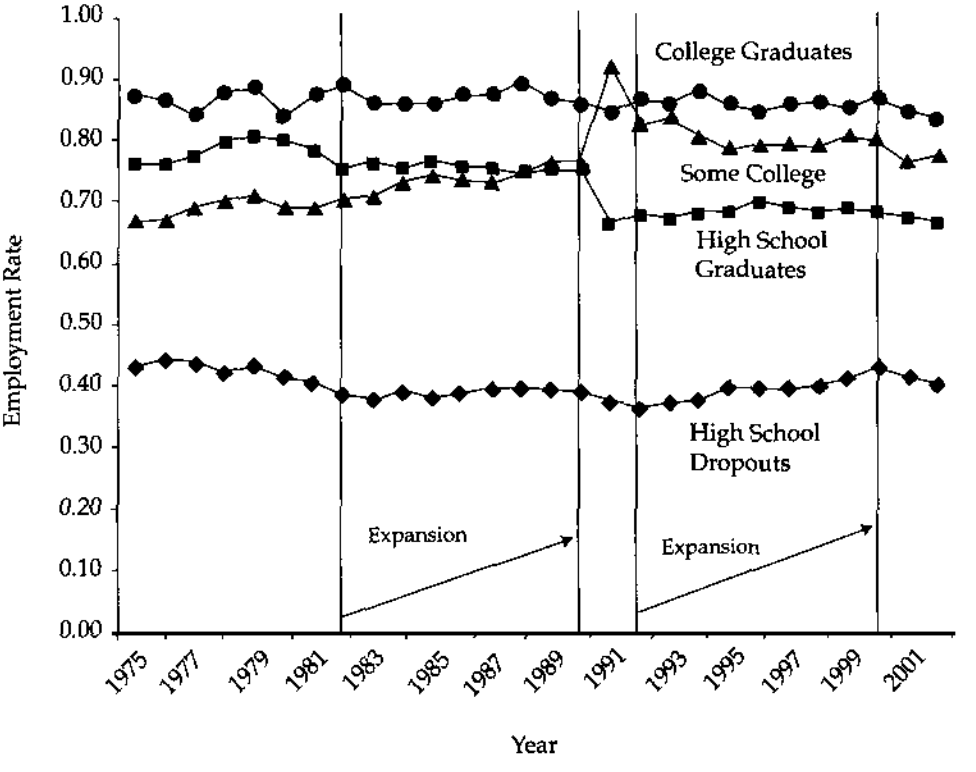


Source: Author's compilation.
Notes: Number of people with earnings, CPS (source above) multiplied by average earnings from figure 3.4, divided by estimated population in the education group. Population twenty-five and older from the CPS (source above), table A-2. I approximated the distribution of the population age sixteen to twenty-four by tabulating the distribution from the raw data for the March 2003 CPS (using the Census Bureau's Data Ferrett program) and applying the distribution to the number of people age sixteen to twenty-four obtained from U.S. Census Bureau, *Historical Statistics of the United States*, table HS-3. This source gives the population age fifteen to twenty-four, so I approximated the population as 90 percent of the reported number. Adjusted as in figure 3.4 for compensation omitted from the CPS. Deflated by the consumption deflator.

point for the two less-skilled groups around 1990. Earnings in these groups rose during the 1990s, though not as fast as for those with higher education.

Growth in earnings per person decomposes into growth in earnings per worker and growth in workers per person, that is, in employment rates. Figure 3.6 shows employment rates measured as the fraction of the population with any earnings at all during the year. The only group with important systematic varia-

FIGURE 3.6 / Employment Rates by Education



Source: Author's compilation.
Note: Ratio of number of people with earnings to total population in education group, using sources as in figure 3.5.

tions in employment rates is high school dropouts. Their employment rate rose by almost 2 percent per year in the boom of the 1990s, after having been essentially constant in the boom of the 1980s. A further decomposition by sex would show some disparity.

The other element of the decomposition is real earnings per worker. Table 3.3 shows the CPS data for this measure. Real earnings rose faster in the 1990s than in the 1980s in every education group. The difference is around 1 percent per year—enough to cumulate to more than 8 percent over the length of the boom. Notice that the improvement is the same as shown in table 3.2 for the real wage averaged across education groups. The factors that accounted for favorable wage growth in general—notably the unexplained growth of wages relative to the neoclassical benchmark—operated roughly uniformly across education groups.

TABLE 3.3 / Annual Percentage Growth in Real Earnings per Year, by Education, Expansions of 1982 to 1990 and 1992 to 2000

	Not a High School Graduate	High School Graduate	Some College	College Graduate
1982 to 1990	–0.1	0.6	1.6	1.6
1992 to 2000	1.5	1.4	1.9	2.6
Improvement	1.6	0.7	0.3	1.0

Source: Author's compilation.
Note: From figure 3.5.

The largest improvement in wage growth was for dropouts and the smallest for those with some college but no degree.

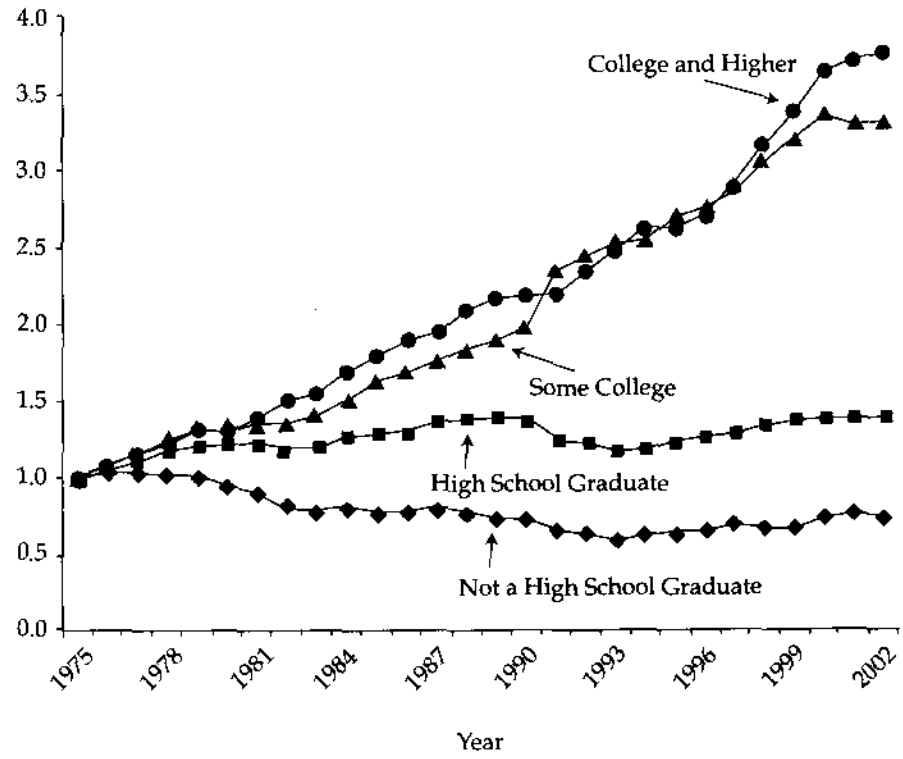
DEMAND BY EDUCATION GROUP

In this section, I discuss an index of the demand for workers in the education groups considered in the previous section. The index is simply total real spending by employers for the workers in the education group. If the elasticity of demand for an education group is one, then the product of the wage and the level of employment is a given amount, independent of the position of labor supply. Further, if labor supply is inelastic, then the number of people in the education group is a measure of supply. Thus, the total earnings of an age group in a year provide a reasonable index of demand in that year, and the number of people measure supply. These are useful measures even if the two elasticity assumptions—one for demand and zero for supply—are not strictly true.

Figure 3.7 shows indexes of total real earnings of the four education groups for the period 1975 through 2002, from the CPS, adjusted to NIPA totals, as described earlier. Rapid increases in demand for the more-skilled workers with at least some college is the most conspicuous feature of the figure. In the lowest skill group, demand fell substantially to a trough in 1993 and has risen since then. This increase in demand was responsible for the favorable performance of earnings per worker in the 1990s. Though the 1990s were famous for the growth of education-intensive industries, such as finance and high-tech, other industries offering opportunities for those with little education also grew. The most important was construction. High school graduates enjoyed modest increases in demand except for a decline following the recession that began in 1990. Table 3.4 summarizes the data for the two long expansions of the 1980s and 1990s.

Some have argued that demand for less-skilled workers fell because the industries that hire these workers have shrunk. Figure 3.8 shows the absence of such a tendency. It is a scatter plot across industries of intensity of low-skilled workers (the fraction of the wage bill earned by dropouts) on the horizontal axis and the

FIGURE 3.7 / Indexes of Labor Demand by Education Group



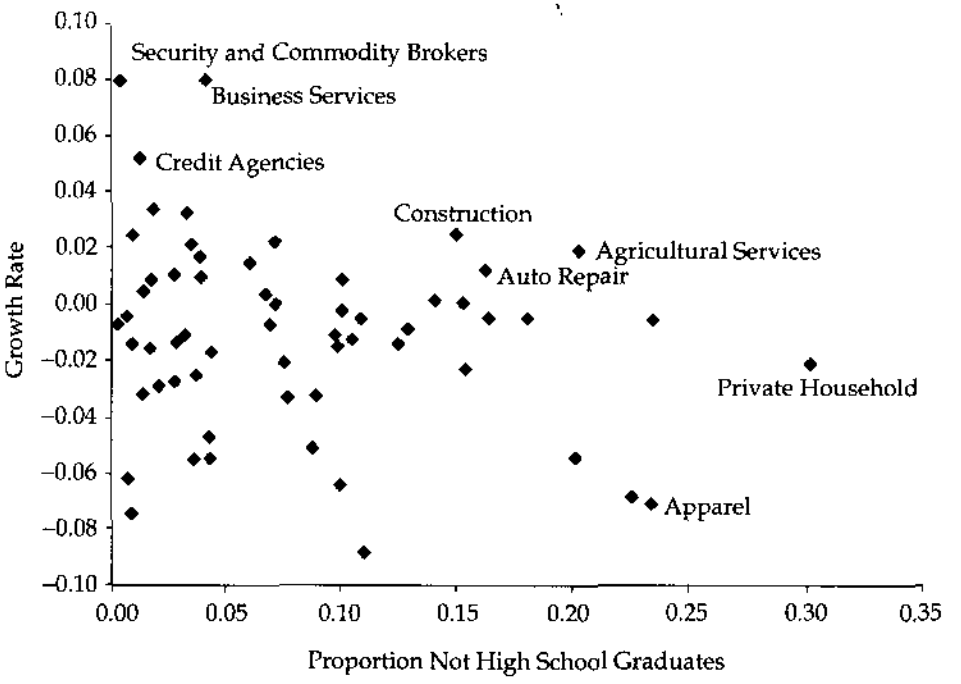
Source: Author's compilation.
Note: Total earnings from figure 3.5, deflated by the GDP deflator.

TABLE 3.4 / Annual Growth Rates of Labor Demand by Education Groups

	Not a High School Graduate	High School Graduate	Some College	College Graduate
1982 to 1990	–1.4	2.0	4.7	4.8
1992 to 2000	2.1	1.5	3.9	5.6

Source: Author's compilation.
Note: From figure 3.7.

FIGURE 3.8 / Low-Skill Share and Low-Skill Growth by Industry, 1992 to 2000



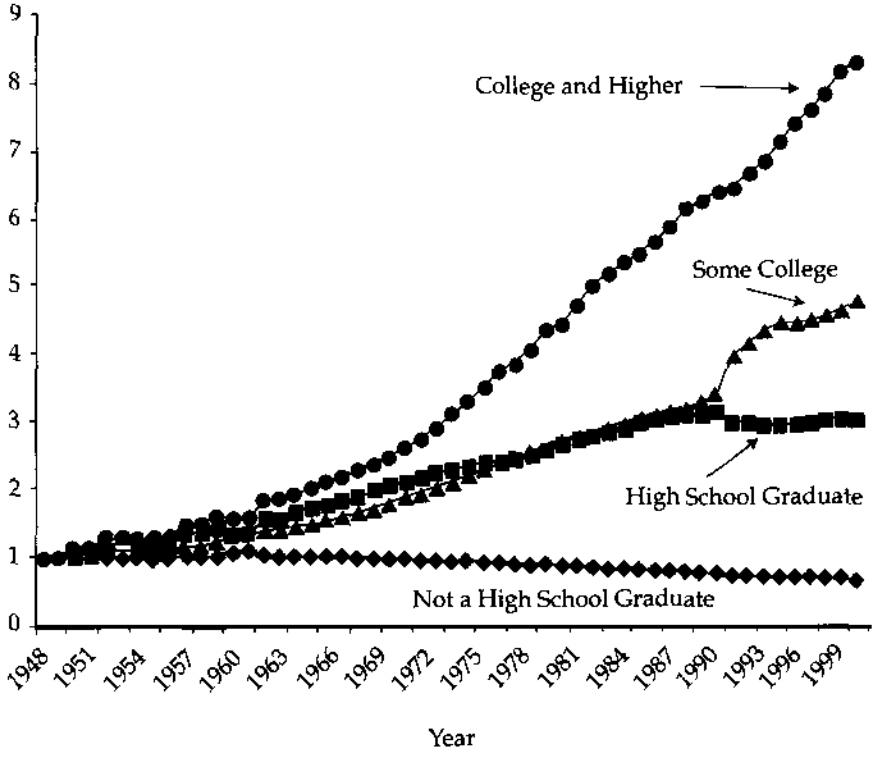
Source: Author's compilation.
Notes: For each industry reported in the NIPA earnings data, table 6.2, the horizontal axis measures the proportion of earnings paid to workers with less than a high school education, obtained from the 2000 census using the DataFerrett, and the vertical axis is compensation in 2000 divided by compensation in 1992, deflated by the consumption deflator.

annual growth rate of demand for low-skilled workers on the vertical axis. There is essentially no correlation between intensity and growth. A few of the industries are identified. Some correspond to general impressions about the changes in the economy over the 1990s: financial services grew rapidly and employ essentially no low-skilled workers; apparel shrank rapidly and is highly intensive in low skills; construction, agricultural services, and auto repair are low-skill-intensive industries that grew during the 1990s.

SUPPLY BY EDUCATION GROUP

The other part of the story of the labor market is supply changes in the education groups. Figure 3.9 shows indexes of the number of people age sixteen and older in each education group since 1948. The less-than-high-school group was roughly constant until the mid-1960s and then began to fall continuously

FIGURE 3.9 / Indexes of the Number of People Age Sixteen and Older, by Education Group, 1948 to 2000



Source: Author's compilation.
Note: Data from figure 3.5.

through the present. The declining size of this population is a key factor in the reduction in poverty over the past forty years. The number of people who graduated from high school but did not go to college at all grew continuously until 1992 and then fell and leveled off. The discontinuous change in the high-school-only group is matched by complementary change in the some-college group, which rose dramatically in the early 1990s. Finally, the number of people with at least a college education rose exponentially throughout the period.

Table 3.5 shows the annual growth rates of the population age sixteen and over by education, for the whole period and for the three major expansions. The dropout population fell in all expansions, especially in the 1980s and 1990s. The 1990s were exceptional for the low growth of the high-school-only population, which grew rapidly in earlier years. The two college-and-higher groups grew rapidly in all years.

TABLE 3.5 / Annual Growth Rates of Population Sixteen and Older

	Not a High School Graduate	High School Graduate	Some College	College Graduate
1948 to 2003	–0.7	2.0	2.9	4.0
1962 to 1970	–0.3	3.5	3.2	3.7
1982 to 1990	–1.5	1.4	2.2	3.7
1992 to 2000	–1.3	0.1	2.4	3.2

Source: Author's compilation.
Note: Data from figure 3.5.

POVERTY AND EARNINGS

As I noted at the beginning of this chapter, the level of earnings of the least-skilled workers is a central determinant of the incidence of poverty. Discussions of poverty often focus on the fraction of people whose family incomes fall below the official poverty threshold. In this section, I make some observations about the complex relation between earnings and poverty.

Figure 3.5 showed that real earnings of the less-skilled population have been roughly stable for the past twenty-five years. Figure 3.9 documented the dramatic reduction in the fraction of the population with less than a high school education. From these figures, we might reasonably infer that the fraction of people in poverty declined over the period. In fact, as table 3.6 shows, poverty rates rose during the 1970s and 1980s and declined in the 1990s, going back to the same levels as in 1975. Progress from improved education did not result in any corresponding overall decline in the incidence of poverty. Rising real earnings in the 1990s were part of the reason that the poverty rate declined in that decade.

A comprehensive reconciliation of these divergent trends is beyond the scope of this chapter. The measurement of poverty involves many contentious issues, including the treatment of in-kind and monetary transfers (see Citro and Michael 1995). I mention here only two of the factors that appear to be important. First, the distribution of earnings within each education group is highly dispersed. As usual in data on individuals, within-group dispersion exceeds cross-group dispersion. Increasing dispersion of earnings is probably a factor in the failure of the poverty rate to decline.

Second, the poverty rate is based on family income for people who live in families. The definition of poverty presumes high returns to scale in family operation. For example, in 2003 the poverty threshold for a single adult under age sixty-five was $9,573, while the threshold for a couple was $12,321. A couple with an income of $16,000 is well above the threshold, but if they decide to live separately and divide their income equally, both will be in poverty with incomes of $8,000. The definition incorporates such high returns to scale because it is

TABLE 3.6 / Poverty Rates (Percentages)

Year	People in Poverty	People in Families in Poverty
1975	12.3%	10.9%
1990	13.5	12.0
2003	12.5	10.8

Source: Author's compilation.
Notes: Data from census poverty data, table 2, "Poverty Status of People by Family Relationship, Race, and Hispanic Origin, 1959 to 2003," http://www.census.gov/hhes/poverty/histpov/hstpov2.html.

based not on consideration of the economies from all sources of living together, but only on preparing and consuming food. Even at the conceptual level, the poverty measure does not consider preferences about living arrangements.

The high level of returns to scale built into the poverty definition has had a large effect on the measured incidence of poverty because of an important trend away from cohabitation. In 1960 the United States had 3.4 people per household. This figure fell to 3.0 in 1975 and to 2.6 in 2003.

Because households do enjoy returns to scale, measures of poverty should consider this issue. Americans have spent a good part of the benefit of rising real earnings on the establishment of additional households. Older people are less likely to live with their offspring. The fraction of the population living with spouses has declined. The current official definition of poverty makes a large deduction on account of the proliferation of households without considering the benefits that people may achieve by living separately.

RECESSIONS

Every five or ten years, the economy sinks into a recession. Employment falls, unemployment rises, and the labor market enters a period of slack that may last several years after the end of the contraction itself. The most recent recession ran from early to late 2001, but the unemployment rate even at the time of writing in late 2005 is still well above its pre-recession level. How do recessions affect earnings in general and the earnings of the least-skilled in particular?

Recessions tend to undo some of the gains of the preceding expansions. Table 3.7 presents the data on real earnings per person from figure 3.4 as percentage changes from the peak year to the second year following the peak. (In the case of 2000, the business cycle peak occurred in early 2001, but with annual data it is appropriate to treat 2000 as the peak, since the economy declined substantially during 2001.)

Recessions are times of shrinking earnings per person, mainly because of higher unemployment. In the two earlier recessions, the least-skilled suffered large reductions in earnings, while those with at least some college had increases

TABLE 3.7 / Two-Year Changes in Real Earnings per Person in Three Recessions

	Not a High School Graduate	High School Graduate	Some College	College Graduate
1981 to 1983	–11.6	–5.6	–0.2	–0.2
1990 to 1992	–9.6	–9.4	4.0	3.4
2000 to 2002	–4.5	–0.2	–4.0	–4.7

Source: Author's compilation.
Note: Data from figure 3.5.

or only small decreases. The most recent recession looks quite different. All skill groups had declines—only the high-school-graduate group avoided substantial earnings losses. But the least-skilled, dropout group had about the same earnings reductions as those with at least some college. The reason is the unusual industry composition of the most recent contraction. Construction, an industry with substantial employment of the least-educated workers and normally a major victim of recessions, enjoyed employment increases.

CONCLUSIONS

One of the important determinants of poverty is the earnings of low-skilled workers. I have examined both the overall behavior of real earnings and the behavior of the earnings of people who did not finish high school. In the 1990s, overall earnings rose slightly less in relation to the prices of private goods and services produced in the United States than they did for the past fifty years, but the rise was well above what occurred in the boom of the 1980s. Productivity growth was unusually low in the 1990s, below even the 1980s, but capital deepening made an important contribution to wage growth. In addition, wages grew spontaneously by about six-tenths of a percent per year over the simple neoclassical benchmark set by productivity growth and capital deepening. The extra wage growth has a number of plausible explanations, such as improving competition in product markets. Thus, one of the reasons that the 1990s were a relatively good period for the unskilled was the reasonably high rate of growth of wages in relation to the prices of goods and services produced in the United States.

I have not tried in this chapter to translate wages paid into some kind of bottom line of wages received after taxes and other costs, such as fringe benefits, that employers pay but workers do not receive in cash, and after taxes and other working costs paid by workers themselves. The only adjustment I have explored is for the terms of trade—that is, for the fact that workers spend their wages in part on products imported from the rest of the world. This adjustment is slightly negative for the 1990s, but not nearly as negative as it was in the 1980s. Real

wages in the sense of compensation divided by the cost of living rose by about 1.8 percent per year in the 1990s, below the fifty-two-year average of 2.1 percent but above the rise of 0.7 percent per year in the 1980s.

The 1990s were also a good period for the earnings of unskilled workers. Real earnings rose by 1.5 percent per year for those who did not finish high school, a bit better than the 1.4 percent for those who graduated but did not continue. By contrast, real earnings in the lowest education group fell during the 1980s. The least-educated enjoyed an acceleration of wage growth of 1.6 percent per year in the 1990s over the 1980s.

To understand the favorable experience of the least-skilled in the 1990s, I studied demand and supply. Real compensation paid to a group of workers serves as an index of demand. The results for the lowest-skilled group showed an annual growth rate of 3.5 percent in the 1990s, compared to 1.8 percent in the 1980s. Demand growth in the 1990s was about equal for all four education groups. Although some industries that employ large proportions of the least-educated workers—such as apparel—declined in the 1990s, others—such as construction and auto repair—expanded.

The declining supply of unskilled workers also contributed to their favorable experience. The number of people age sixteen and older with less than a high school education fell at a rate of 1.3 percent per year in the 1990s. The number of people who finished high school but did not continue to college—which had grown rapidly from 1948 until 1992—hardly grew at all during the period 1992 to 2000.

The favorable performance of low-skilled wages in the 1990s contributed to a moderate decline during the decade in the incidence of officially measured poverty. But this improvement only brought poverty back to the level of 1975. The fraction of the U.S. population living at the low standard of the poverty threshold has not declined despite stable earnings per person among the least-skilled and a declining fraction of the population in the lowest skill category. Increases in within-category dispersion of earnings and the strong trend toward living in smaller households, with the resulting sacrifice of economies of scale, are two influences among those that account for the differences in the two measures of performance—earnings of the least-skilled per person and the incidence of poverty.

What is the outlook for earnings growth among the least-skilled and the resulting amelioration of poverty in the current decade? As I have stressed throughout the chapter, rising productivity is the primary driving force of rising real wages. Productivity has grown rapidly so far in the decade, and the outlook for further growth is favorable, though it will probably not occur at the same high rate seen from 2000 to 2004. Some of the forces that helped the low-skilled over the past ten years, notably the rapid growth of construction employment, are unlikely to continue. The end of the housing bubble forecasted by every real estate expert will bear negatively on the less-educated workforce of that industry. There is every reason to expect the continuation of the forces that have delivered rapid real earnings growth to the more-educated as the United States continues to

delegate the physical production of goods to other countries and to specialize in administration, research, and other function that call for a college education. All workers are at risk for downward pressure on real earnings from higher energy prices, though the magnitude of this effect so far, with oil prices more than doubling, has been tiny.

NOTE

1. This research is part of the Program on Economic Fluctuations and Growth of the National Bureau of Economic Research. A complete spreadsheet with all data, showing the details of all calculations, is available at stanford.edu/~rehall.

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