Trends in wage and salary inequality, 1967–88

*Earnings inequality in the United States
rose in the late 1960's, stabilized for most
of the 1970's, then began to grow again
in the 1980's; the recent increase arises
from changes in labor demand, and not
demographic characteristics of U.S. workers*

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During the last several years, research on the distribution of income and earnings in the United States has expanded substantially.[1] In part, this reflects the perception that inequality of earnings has been increasing, leading among other results to increases in poverty. The size and composition of the middle class, and fears of a "declining middle class," have prompted some of the analysis. Still other researchers have been concerned about the economic prospects for a new generation of young adults.

While there is now general agreement about the trend of increasing inequality, particularly during the 1980's, the causes of this increase are still unclear. Some argue that the effects of structural changes in the economy and heightened competition in the international marketplace have led to increasing inequality and diminished the prospects for greater prosperity in U.S. society. Others claim that changes in demographic characteristics of the labor force, some of which cannot be affected by public policy, are the sources of growing inequality.

The purpose of this study is to determine the relative influence of demographic characteristics and labor market factors on the patterns of national pay inequality, for the period 1967 through 1988. As in our previous work in this area,[2] we focus on wages and earnings, rather than total income, and we use a measure of inequality developed by Henri Theil that is particularly appropriate for disentangling the contributions of different factors to pay inequality. We first review the recent literature on inequality to determine potential causes that are worth examining, and then present the methodology of the study. The following sections describe the results, first for demographic factors—age, gender, educational attainment, and race and ethnicity—and then for labor market factors, including industrial and occupational patterns of employment and work patterns (part-time, full-time, and overtime work).

Implications of recent literature

The empirical literature on pay inequality has several strands. Conflicting results have emerged, in part because of differing units of analysis, definitions of income, measures of inequality, and periods of study. It should be noted at the outset that there are substantial differences in patterns of pre-tax and transfer *earnings* compared with the distribution of total *income* including transfers; because transfers offset some of the inequality in earnings, inequality in pre-transfer income has increased more than inequality in post-transfer income.[3] In addition, the distribution of *family* or *household* earnings (or income) differs from the

distribution of *individual* earnings because the process of household formation—including increases in the numbers of female-headed households with low earnings and two-earner households with substantially higher earnings—adds its own complexity to changes in earnings inequality. Finally, while trends in poverty do depend on the distribution of household income, they involve only the lower tail of the distribution, while the concern over the "declining middle class" concentrates on the middle of the distribution, as variously defined.

This analysis concentrates on the inequality arising from employment, because that source of inequality is fundamental to every other form. We therefore examine individual wage and salary income, rather than household or family resources or total income. And, because we are concerned with welfare and purchasing power rather than productivity, we analyze annual earnings rather than wage rates.

The trends in inequality have by now been relatively well established. Peter Henle and Paul Ryscavage were among the first to find increasing inequality among male earners—but not among female earners—beginning around 1966,[4] based on annual data from the Current Population Survey (CPS).[5] Bennett Harrison, Chris Tilly, and Barry Bluestone found a somewhat different pattern, again based on CPS data, that showed a "U-turn" in inequality, with wage and salary variation decreasing between 1970 and 1978 and increasing between 1978 and 1983.[6] On closer examination, the U-turn appears to be the result of combining inequality among men, which has increased especially rapidly since the late 1970's, with the more erratic pattern for women, among whom inequality appears to have decreased throughout the 1970's and then increased more moderately during the 1980's.[7]

However, the causes of these patterns have been much more elusive, and analysts have tested various hypotheses, only to find that they fail to explain trends in inequality. In considering possible causes, a simple framework distinguishing shifts in the supply of labor from changes related to demand for labor is an obvious approach. Among the labor-supply factors, there have been substantial changes in the composition of the labor force as the baby boom, increasing numbers of women, and minorities have moved into the labor force. There also have been continued increases in educational attainment, a trend that reflects labor-supply shifts, but may also indicate changes in demand for labor resulting from technological advances and restructuring of the economy.

The effects of these demographic trends have been unclear. Robert Plotnick ascertained that,

once human capital variables are considered, the time trend in inequality vanishes; in particular, the variance in male earnings associated with age, experience, and weeks worked per year is significant, implying that part-time work and the labor force entry of the baby boomers may be responsible for increasing inequality.[8] However, Martin Dooley and Peter Gottschalk found increases in inequality between 1968 and 1979, even after controlling for individuals' education, experience, and unemployment,[9] and Gary Burtless found that increases in inequality would have been greater over the period 1967–87 had the age structure of the labor force remained the same.[10] These results thus suggest that the decrease in the average age of the labor force with the entry of the baby boomers fails to explain increases in inequality.[11] In further analysis of the CPS data for 1978 and 1984, Tilly, Bluestone, and Harrison showed that demographic changes (including the entrance of the baby boomers into the labor force), shifts in educational attainment, and changing returns to education fail to explain the increasing variance of earnings.[12] However, Burtless determined that educational shifts can explain some of the increase in inequality, and Levy and Murnane's review presents evidence—most of it only loosely tied to measures of inequality—to demonstrate that trends in inequality can be partly explained by the increased earnings premium associated with additional schooling.[13]

In examining the effects of race, James P. Smith and Finnis R. Welch found convergence of the wages of black and white men between 1940 and 1980, although Michael Reich has argued that the pattern of narrowing racial differentials during the 1960's was replaced by a growing differential for men during the 1970's.[14] Consistent with this, Saul Schwartz documented an increase in inequality among black men between 1967 and 1979; about two-thirds of this was due to changes in the incidence of unemployment and part-time work, and the remaining one-third to changes in earnings capacity.[15] For women, the convergence in average earnings of whites and blacks has been even more marked than for men, and in recent years, the black-white differential has, in fact, almost vanished.[16] However, race (defined as black and nonblack) does little to explain overall changes in inequality, simply because blacks are a relatively small proportion of the total labor force. Due to data limitations, the effect of the increasing proportions of Hispanics on the earnings distribution has not been well analyzed.

A number of studies have examined labor market changes to determine how trends in the demand for labor might affect pay inequality. Tilly, Bluestone, and Harrison found that changes in sectoral shares of employment and growing

proportions of part-time workers accounted for part of increasing inequality.[17] Grubb and Wilson also determined that sectoral changes in industrial structure contributed to greater inequality in earnings, although both studies showed a large fraction of increasing inequality to be unexplained by any variables.[18] Shifts in occupational patterns have not been extensively analyzed, although Grubb and Wilson found that the economic sectors with the greater increases in inequality have been those with the more highly skilled and highly educated workers, suggesting that occupational shifts might be partly responsible for changes in inequality. Of course, it is also possible that cyclical patterns account for apparent trends in inequality, but Burtless determined that very little of the increase in inequality—at most one-fifth of that for men, and none of the variation for women—can be attributed to cyclical variations in unemployment.[19]

One other factor related to the demand for labor may be responsible. Tilly, Bluestone, and Harrison found that increases in part-time work are partly responsible for increasing inequality in annual earnings.[20] Consistent with this, several studies that have noted decreasing inequality in recent decades have measured inequality in weekly earnings or hourly wages,[21] suggesting that increasing inequality in hours worked has more than offset greater equality in wage rates.

Finally, it is reasonable to suspect that geographic shifts in employment may have contributed to inequality, as the population has moved from the high-wage North and Midwest to the lower wage South and Southwest. However, Grubb and Wilson have shown that regional shifts, while substantial, made no difference to overall inequality during the period 1960–80 because mobility among regions was accompanied by a convergence among regions in earnings levels, and because most inequality is intrastate or intraregional rather than interstate or interregional.[22] Our preliminary study of annual CPS data confirmed that differences among regions contributed very little to patterns of inequality after 1980,[23] and we have therefore dropped regional patterns from the analysis presented here.

In sum, there have been substantially different trends in patterns of earnings inequality for men and women. Racial patterns, while markedly different for men and women, cannot explain much of the overall trend. While the contributions of age and the labor force entry of the baby boom are unclear, there is increasing evidence that educational changes can help to explain recent patterns. Shifts of employment among economic sectors appear to have some (but not overwhelming) explanatory power; and changes in the incidence

of full-time and part-time employment seem to play a role in increasing inequality, at least among men. The effects of occupational trends have not been well examined, although circumstantial evidence suggests that they merit further analysis. Population shifts among regions have been substantial, but they have had little influence on trends in inequality. Thus, while there have been increases in inequality, the causes remain elusive.

Methodology

In previous work, we examined inequality in individual earnings using decennial census data, concentrating on the effects of gender, race, regional population shifts, and sectoral employment shifts.[24] In this article, we present similar results, using annual CPS data for the period 1967–88 to analyze the effects of gender, age, education, the sectoral and occupational composition of the labor force, and changes in work patterns (part-time, full-time, and overtime work). The use of annual CPS data allows us to study the patterns of inequality during the 1980's—when, by all accounts, inequality rose rapidly. We measure inequality using a statistic developed by Henri Theil, based on entropy theory.[25] The Theil measure, which we refer to as T, is:

$$(1) \quad T = \frac{1}{n}\sum\left(\frac{Y_i}{u_Y}\right)\log\left(\frac{Y_i}{u_Y}\right)$$

$$= \frac{1}{n}\left[\sum\frac{(Y_i \log Y_i) - (u_Y \log u_Y)}{u_Y}\right]$$

where u_Y refers to the mean of Y. The second expression makes it clear that T is the dispersion of $Y_i\log Y_i$ around its mean, standardized by the mean (where $\log Y$ refers to the natural log). Theil's measure is scale invariant, so that it is unaffected by inflation. It also adheres to the principle of transfers, which dictates that a measure of inequality should increase when income is transferred from a low-wage earner to a high-wage earner. The change in T for a transfer from a person with earnings Y_1 to one with earnings Y_2 depends on $\log (Y_2/Y_1)$; thus, a transfer of earnings from someone with an income of $6,000 to one with a $5,000 income decreases T as much as a transfer between someone with income of $60,000 and one with $50,000. If we assume diminishing marginal utility of income, this is a desirable property. Finally, T is bounded from below by zero, at which point everyone has the same income; at the other extreme, where one person has all the income and the remaining $n-1$ people have none, the upper bound is $\log n$. Theil has argued that the tendency of the upper bound to increase with the population n is appropriate, because a society of 1,000 people in which one person has

all of the income is more unequal than a two-person society in which one person has all of the income. If the upper bound were a problem, then Theil's T could be transformed into a measure with bounds of zero and 1 (like the Gini coefficient) by dividing through by log n. However, in the distributions we examine, which are approximately log normal, the upper bound is irrelevant, and so we use the conventional T bounded by log n.[26]

Aside from simplicity of calculation, an advantage of T is that it can be readily decomposed into terms representing variation among groups and variation within groups. For any number of mutually exclusive and exhaustive groups:

$$(2) \quad T = \sum \left(\frac{p_j \mu_j}{u_Y}\right) \log \left(\frac{u_j}{u_Y}\right) + \sum \left(\frac{p_j \mu_j}{u_Y}\right) T_j$$

where p_j is the proportion of individuals in the jth group; u_j is mean earnings for the jth group; u_Y is the overall mean; and T_j is Theil's T for the jth group. The first term on the right is the contribution of variation among groups to overall inequality; it increases with the dispersion of average group earnings u_j around the overall mean u_Y, and is higher when there are larger proportions of individuals in groups with mean earnings very different from the overall mean. The second term is the contribution to overall inequality of within-group variation, which is a function of T_j's, suitably weighted; this term can also be expanded to show the contribution of individual groups—for example, of specific economic sectors—to overall inequality.

This decomposition makes it clear that inequality is affected by three factors: (1) The proportion of the labor force p_j in different groups, particularly as there are trends toward higher (or lower) proportions in groups with greater earnings inequality T_j, or higher proportions in groups whose earnings means u_j are far from the overall mean u_Y. An example would be a shift of earners from occupations near the national average into occupations with relatively high or low average earnings. (2) Inequality within groups, because increases in the individual T_j's increase overall inequality as well. (3) Increasing variation of the group earnings mean u_j around the overall earnings mean u_Y. This makes it clear that changes in inequality due to any one variable can be quite complex. For example, the shift of employment from manufacturing to services (a change in p_j) might itself increase inequality, but such a shift might be accompanied by changes in the T_j and in the earnings ratios u_j/u_Y that could either reinforce or offset the increasing inequality. Thus, it is inadequate to concentrate only on shifts among sectors, or among groups defined by age or educational attainment—that is, on the p_j—in explaining inequality.

The decomposition in equation (2) can most easily establish the effects of among-group and within-group inequality, but—because the effects of p_j, T_j, and u_j/u_Y are interactive—it is more difficult to see which of these three components is responsible for changes in overall inequality. To analyze this, we take the total derivative of T with respect to time t. This derivative can then be decomposed into three terms: one for the proportion of workers in each grouping p_j, one for the wage ratio u_j/u_Y, and one for the inequality within each group T_j:

$$(3) \quad \frac{dT}{dt} = \sum \left(\frac{\partial T}{\partial p_j}\right)\left(\frac{\partial p_j}{\partial t}\right) + \sum \left(\frac{\partial T}{\partial r_j}\right)\left(\frac{\partial r_j}{\partial t}\right) + \sum \left(\frac{\partial T}{\partial T_j}\right)\left(\frac{\partial T_j}{\partial t}\right)$$

where:

$$r_j = \frac{u_j}{u_Y} \quad \text{(the earnings ratio for group } j\text{)};$$

$$\frac{\partial T}{\partial p_j} = r_j \log r_j + r_j T_j;$$

$$\frac{\partial T}{\partial r_j} = p_j \log r_j + p_j + p_j T_j; \text{ and}$$

$$\frac{\partial T}{\partial T_j} = p_j r_j.$$

This demonstrates that increases in within-group inequality (T_j) increase overall inequality, especially if the increases take place in groups accounting for high proportions of the work force and having high earnings ratios relative to the population mean. Increases in the proportions of the labor force in particular groups (the p_j) increase overall inequality if r_j, the earnings ratio, is above 1; if r_j is sufficiently low and the within-group inequality T_j is low, then $\partial T/\partial p_j$ can be negative. Finally, the effect of an increasing earnings ratio r_j is normally to increase inequality unless r_j is quite low, in which case the movement of a group mean toward the overall mean decreases inequality.

For particular groups, indexed by j—for example, educational-attainment groups, or workers by industrial sector—the total derivative can then be calculated for year-to-year changes, and plotted. Given annual CPS data, we can then see whether changes in overall inequality due to the composition of the labor force by level of education, for example, are the result of changes in the proportions of workers with different educational attainment, changes in the earnings ratio associated with different educational levels, or changes in inequality among individuals with the same level of education.[27] While it is straightforward to calculate the components of dT/dt for individual years, the resulting plots are difficult to read; we therefore present the cumulative changes

from 1967 to various years, because patterns for these cumulative changes are more easily interpreted.[28]

In this study, we use data from the March supplement to the Current Population Survey for the period 1967–88.[29] We include only individuals aged 16 or older with positive (nonzero) annual earnings; and we examine wage and salary income rather than total earnings, which may include self-employment income.[30] By analyzing wages and salaries rather than total earnings, we concentrate on the consequences of employment decisions by firms. The pattern of inequality in total earnings is similar to that of inequality in wages and salaries, although overall inequality is slightly greater for the former.[31]

Categorical variables describe seven characteristics of individuals and their employment. Demographic variables include gender, age, race and ethnicity, and educational levels; labor market variables describe an individual's industry of employment; occupation; and work pattern, defined as overtime, full-year full-time, full-year part-time, part-year full-time, or part-year part-time.[32] The appendix contains more detail about each variable.

Research findings

The measures of earnings inequality in table 1 indicate that overall inequality increased in the late 1960's, and then remained relatively stable for most of the 1970's.[33] In the 1980's, inequality increased again, reaching a peak in 1986 and then declining in 1987 and 1988. While the overall pattern is similar to that found in the literature in which a similar measure is used,[34] the downturn in 1987 has not been reported except by Ryscavage and Henle,[35] who found a very small drop in the Gini coefficient, and by Lynn Karoly for 1985 and 1986.[36] Whether this downturn is the harbinger of a long-run decrease in inequality or reflects a temporary decrease that will be reversed is unclear, although we offer some speculations in the conclusion to this article.

As others have found, the overall patterns of inequality mask substantial differences between men and women. The increases in inequality during the later 1960's and the first half of the 1980's were much sharper among men, with relative stability noted during the 1970's. There are several possible implications of this trend; for example, it may be partly responsible for increasing rates of female labor force participation, as some families found themselves unable to meet customary standards of living with husbands' earnings alone, and it also may have contributed to increasing rates of divorce and separation. For women, an increase in inequality between 1968

and 1970 was followed by a decrease during the 1970's, from a high of 0.367 for the Theil T in 1970 to a low of 0.324 in 1981; during the 1981–86 period, inequality increased (as it did for men), and decreased in 1987 and 1988. However, the increases among women in the late 1960's and in the 1980's were smaller than those among men; because of the intervening decrease, inequality remained the same among women over the entire 1967–88 period while it increased substantially for men. This implies that, while the growing inequality of earnings during the late 1960's and the 1980's was caused by increases among both men and women, male inequality was the more important factor; and the relative stability of the 1970's was the result of an increase among men offset by a decrease among women. In subsequent analysis, we plan to analyze patterns separately for men and women; in the remainder of this article, we focus on overall inequality.

In the last three columns of table 1, overall inequality is decomposed into within-group and among-group components. (In this particular table, worker groups are determined by all combinations of age, education, gender, industry, occupation, and work patterns.) Differences among these detailed groups account for roughly 70 percent of overall inequality; that is, 70 percent of inequality can be explained by variation among groups in earnings (the term u_j/u_y) and by the relative sizes of different groups of workers, represented by p_j. Roughly 30 percent of inequality occurs within groups of similar workers.[37] This particular source of inequality is troublesome because it is difficult to explain, although we offer some speculations in our conclusions.

Among- and within-group inequality follow the same general pattern: stability or decreases in the 1970's, increases in the late 1970's and early 1980's, and decreases in 1987–88. The timing of changes in the two types of inequality is distinct, however. Within-group inequality, which shows sharper changes, started increasing in 1975, and continued to do so until 1986. Increases in among-group inequality did not begin until the early 1980's, and lasted only until 1984, followed by a decline in this component of inequality. Furthermore, there are distinct differences between the two periods of growing inequality: changes in the late 1960's were caused entirely by increases in among-group inequality,[38] while those in the 1980's were due more to within-group inequalities than to among-group variation.[39] This poses a challenge to researchers: the component of inequality that is most difficult to explain has been of the greatest importance during the 1980's.

Demographic factors. Demographic changes may have been responsible for increasing in-

Table 1. **Decomposition of national Theil (T) coefficients, 1967–88**

| Year | National Theil coefficient (T) | Theil coefficient for— | | Within-group[1] contribution to T | Among-group contribution to T | Share explained by among-group differences |
		Men	Women			
1967.......	0.337	0.248	0.342	--	--	--
1968.......	.336	.248	.335	--	--	--
1969.......	.352	.258	.348	--	--	--
1970.......	.358	.266	.367	0.104	0.254	0.709
1971.......	.358	.272	.356	.101	.256	.715
1972.......	.363	.277	.356	.109	.254	.700
1973.......	.363	.271	.355	.104	.259	.713
1974.......	.359	.275	.345	.106	.253	.705
1975.......	.358	.278	.341	.100	.258	.721
1976.......	.360	.280	.345	.102	.258	.717
1977.......	.360	.282	.336	.103	.257	.714
1978.......	.356	.276	.333	.103	.253	.711
1979.......	.351	.275	.330	.106	.245	.698
1980.......	.347	.278	.326	.103	.244	.703
1981.......	.360	.298	.324	.108	.253	.703
1982.......	.372	.317	.337	.113	.258	.694
1983.......	.369	.317	.340	.113	.256	.694
1984.......	.378	.325	.344	.115	.263	.696
1985.......	.375	.323	.344	.117	.258	.688
1986.......	.378	.326	.350	.120	.258	.682
1987.......	.372	.325	.344	.118	.254	.683
1988.......	.367	.319	.344	.116	.251	.684

[1] Groups are defined by gender, age, education, industry, occupation, and work patterns. See appendix for details.

equality, as greater numbers of low-earning women, minorities, and younger workers moved into the labor force. Increases in the earnings differences among groups at different levels of educational attainment could have been a factor, although a countervailing trend toward greater equality in the distribution of education[40] would have reduced inequality. However, while the four demographic variables we include—age, gender, educational attainment, and race and ethnicity— have distinct effects on earnings inequality, they do not completely explain the patterns in table 1. We first report the effects of each variable individually and then, after demonstrating that the effects of race and ethnicity are minimal, we report on the combined effects of the other three variables.

The coming of age of the baby boom generation had a clear effect on the age composition of U.S. workers, initially leading to a labor force with considerably more young workers. Differences in earnings patterns among age groups do indeed contribute to overall inequality, as reflected in table 2, but among-group inequality due to age patterns remained fairly constant during the study period, except for an increase between 1967 and 1971 and a decline at the very end of the period. (The among-group measures of variation reported in this table correspond to the first term on the right-hand side of equation (2), in which *j* indexes different demographic groups.) Thus,

changes related to the labor force entry of the baby boomers can explain the earlier period of increasing inequality, but not that of the 1980's: as a share of total inequality, age-related among-group inequality declined over that entire decade, indicating that age has become a less significant factor in explaining inequality and undermining the baby boom hypothesis.

By examining the total derivative of T with respect to time, we can clarify this effect. Chart 1 plots the cumulative change for each of three components of dT/dt from equation (3). Changing proportions of workers in different age categories—that is, the relative increase in the number of young workers—decreased inequality until about 1978, at which time its effect began to increase inequality. However, changes in earnings ratios for different age groups (u_i/u_r) had the opposite effect. Earnings ratios for different age groups expanded and then narrowed, as baby boomers entered successive age groups over the period; but overall changes in earnings ratios increased inequality until 1977, and decreased it thereafter as baby boomers moved into age groups closer to the middle of the earnings distribution. Thus, changes in the age composition of the labor force were roughly offset by changing wage ratios. (This pattern of countervailing effects of the different components associated with age may explain the dispute in the literature about cohort effects on earnings patterns.) In contrast, inequality within age groups did contribute to in-

creasing inequality, particularly after 1980, and particularly among the youngest workers (those aged 16 to 19 and 20 to 29). Over the entire period 1967–88, however, the age structure does little to explain the overall trend of inequality, because increases during the first half due to changing age patterns are offset by decreases during the second half.

The gender composition of the work force, however, did have a clear role in decreasing overall inequality, particularly after 1973—confirming our earlier findings.[41] The reason is that women as a proportion of the labor force rose steadily during this entire period, from about 40.6 percent to about 47.3 percent; at the same time, the earnings ratio—the ratio of women's average earnings to the national mean—increased, from 0.573 to 0.707, so that inequality between men and women fell. Thus, the growing numbers of women in the work force have been moving into jobs with earnings closer to the mean. When we examine the total derivative of T with respect to time, the changing proportion of women in the labor force is the most powerful of the three components of dT/dt in reducing inequality, because its effect is consistently negative.

On the other hand, earnings variations among groups at different educational levels have tended to increase inequality, particularly since 1979 (confirming the findings of Burtless,[42] also based on Theil's measure of inequality). This overall result masks interesting trends in the components of change. During the period 1967–88, the proportion of workers with higher levels of schooling increased: those with some college grew from 13 to almost 21 percent of the labor force, those with 4 years of college went from 7 percent to 13.4 percent, and those with more than 4 years of college increased their share from 4 percent to almost 9 percent. Well-educated groups obviously have earnings ratios that are high—for example, between 1.8 and 1.95 for those with more than 4 years of college, and between 1.4 and 1.6 for those with 4 years of college—so that a relative shift of workers into well-educated groups increases the earnings dispersion among groups, as can be seen from the positive contribution to inequality of changes in the proportional representation of the groups. (See chart 1.) At the same time, earnings ratios for individuals with high levels of education tended to fall during the first half of the study period, and then to increase (for example, from 1.783 in 1979 to 1.892 in 1986 for those with more than 4 years of college, and from 1.428 to 1.489 for those with 4 years of college), while earnings ratios for those with high school diplomas and less fell steadily (from 0.734 to 0.620 for those with elementary education; from 0.660 to 0.559 for those with some high school; and from 0.931 to 0.856 for those with a high school

diploma). After 1979, therefore, greater dispersion in earnings among workers grouped by educational levels contributed substantially to increasing inequality. Finally, as is true for other groupings, within-group inequality increased during this period, although most of this change was concentrated within the groups having only an elementary education or "some high school"—groups of dwindling importance in the labor force, but still representing 16.8 percent of workers in 1988.

In our earlier work based on decennial census data,[43] race explained little of national inequality, and this was still the case when we used annual CPS data. One problem with our previous analysis was that the racial variable could only take the values "black" and "nonblack." The increasingly important category of Hispanic-Americans could not be constructed for the census data. However, CPS data for the years 1985 forward enable us to distinguish Hispanics and "others" (largely Asian-Americans) from blacks and whites. The contribution of these four race-ethnicity groups to inequality for the period 1985–88 is shown below:

	1985	1986	1987	1988
National Theil coefficient	0.375	0.378	0.372	0.367
Among-group contribution to T	.007	.007	.006	.007
Within-group contribution to T	.368	.370	.368	.360
Marginal effect of race-ethnicity[44]	.010	.010	.011	.012

We again find that differences in race and ethnicity contribute little to overall inequality. While well-known differences in mean earnings exist among racial and ethnic groups, the fact that relatively small proportions of workers are nonwhite means that the effects of their earnings on the overall distribution are quite limited. Given the weak explanatory power of race and ethnicity, this variable is excluded from further analysis.

Finally, we examine the combined effects of gender, age, and educational variables, in column 4 of table 2. While differences among groups defined by demographic characteristics account for two-fifths to one-half of overall inequality, among-group variation declined during the study period, both absolutely and as a share of total inequality. The contribution of changes in educational attainment to increasing inequality is slightly more than offset by the effects of gender shifts, which reduce inequality. Overall, then, demographic factors have been of declining significance in explaining earnings inequality.

Labor market factors. In this section, we examine how changes in the composition of jobs in the economy—specifically, changes in economic

sectors, occupations, and work patterns—affect earnings inequality. Among-group differences for these three factors explain a significant share of inequality over the study period, accounting for 52 to 56 percent of total inequality. (See table 3.) Among-group differences increased for each of the three factors, but taken together they explained a slightly smaller share of overall inequality beginning in the late 1970's.

The sectoral composition of the work force changed significantly over the study period. We use our own definitions of economic sectors, described in the appendix, to provide sufficient detail about the shift from manufacturing to service occupations, and to isolate the effects of advanced technology.[45] Manufacturing, in which mean salaries tend to be higher and inequality lower than in services, accounted for 28.8 percent of the employment in 1967 and 19.2 percent in 1988. The characteristics of service employment, which expanded substantially during this period, tend to be quite diverse. Distributive services, wholesale trade, and public administration have high mean salaries and low intragroup inequality. The larger retail trade and consumer services sectors tend to have low mean salaries and relatively high inequality. Producer services have a somewhat high mean salary, but also high inequality.[46] Yet, despite dramatic shifts in employment structure and earnings differences among industries, this factor made only a small contribution to changes in overall inequality, tending to

diminish variation in the early 1970's, and then to increase it modestly in the early 1980's. The causes of the rise in the latter subperiod were the changing earnings ratios in certain sectors, which increased particularly for those working in high-earnings fields dealing with advanced technology and in distribution and wholesale trade, and fell in poorly paid retail trade.

Differences among occupational groups explain a somewhat greater fraction of inequality than do sectoral variations. The temporal patterns are similar: trends in earnings of occupational groups tended to reduce inequality during the early 1970's, and consistently increased inequality after 1979, until a decline emerged for 1987 and 1988. Examining components of this trend indicates that the changing proportions of workers in various occupational categories has been the most consistent explanation of increasing inequality, especially since the mid-1970's. (See chart 1.) The category of managerial, professional, and technical workers, who have high mean salaries and relatively low levels of intragroup inequality, increased their share of the labor force from 20.4 percent in 1970 to 27.9 percent in 1988. The craft and operative groups both diminished in relative size; because craft-workers have high mean salaries and low within-group inequality, and operatives have low mean salaries and moderately high inequality, the net effect of the decline of these two groups is small. Workers in sales occupations, with moderately

Table 2. **Among-group Theil coefficients for selected demographic characteristics, 1967–88**

Year	Age	Gender	Education	Age, gender, and education	Share explained by demographic factors
1967	0.059	0.067	0.036	0.158	0.469
1968	.060	.068	.033	.157	.467
1969	.065	.072	.036	.168	.477
1970	.065	.067	.037	.164	.458
1971	.066	.065	.037	.164	.458
1972	.067	.067	.036	.164	.452
1973	.067	.071	.036	.167	.460
1974	.068	.067	.034	.161	.448
1975	.067	.064	.042	.164	.458
1976	.067	.063	.040	.161	.447
1977	.069	.064	.042	.164	.456
1978	.066	.064	.041	.160	.449
1979	.063	.061	.041	.153	.436
1980	.064	.055	.043	.150	.432
1981	.066	.055	.046	.153	.425
1982	.067	.049	.053	.154	.414
1983	.067	.045	.054	.151	.409
1984	.067	.047	.059	.156	.413
1985	.065	.045	.060	.153	.408
1986	.065	.044	.063	.154	.407
1987	.065	.041	.060	.148	.398
1988	.061	.039	.060	.143·	.390

high mean salaries and inequality, remained steady as a share of the labor force, while those in clerical occupations, with quite low mean salaries but moderate levels of within-group inequality, grew during the 1970–88 period. The category of consumer service occupations, which is large and has very low mean salaries and very high inequality, did not change its relative share of employment during this period. However, the contribution of these changes to increasing inequality was partially offset by shifts in the ratio of group mean earnings to the overall average, which rose toward 1 for farmers and declined toward 1 for managers, salesworkers, and craftworkers. Finally, inequality within occupational groups increased modestly during this period, particularly for managers, clerical workers, farmers, and operatives.

Variation in work patterns explains by far the largest share of inequality of any single variable we have examined, by itself accounting for almost 40 percent of national earnings inequality. Its contribution to inequality follows a cyclical pattern, reaching high points in 1976 and 1984; over the entire study period, there was an upward trend in its effect on inequality, largely because of an increase between 1967 and 1969. There are striking differences in inequality among the five work-pattern categories, however. Persons who work full-time and overtime have low within-group inequality and high mean earnings. The two groups of part-time workers—those who work full-year, part-time and those who work part-year, full-time—have lower mean earnings and higher inequality. The group that fares the worst—those who work part-time, part-year—has very low mean earnings and high within-group inequality.

When we examine the components of changes in inequality due to the distribution of workers among groups defined by work patterns, interesting trends emerge. (See chart 1.) During periods of economic improvement, earnings ratios tend to reduce overall inequality (that is, their contribution shifts from positive to negative) as earnings differences among groups become smaller; conversely, during periods of recession—for our purposes, between 1972 and 1975 and between 1978 and 1982—movements in earnings ratios tend to increase inequality. However, the contribution of changing proportions of workers in different work-pattern groups is consistently the opposite: when economic conditions are improving, increasing numbers of full-time and overtime workers—with relatively high mean earnings—tend to increase overall inequality, with the opposite effect noted during recessions. The procyclical effect of earnings ratios and the countercyclical effect of changing proportions of workers among groups tend to cancel each other out, accounting for the relative stability of the contri-

bution of work patterns to inequality between 1969 and 1983. The third contribution to earnings inequality—that of within-group variation—is relatively erratic during 1969–83, although its effect is consistently positive during 1981–88 and helps explain increasing inequality in the late 1960's and early 1980's, with cyclical variation during the 1970's. Since 1984, changing work patterns have tended to reduce inequality, and are partially responsible for the overall decline in 1987 and 1988.
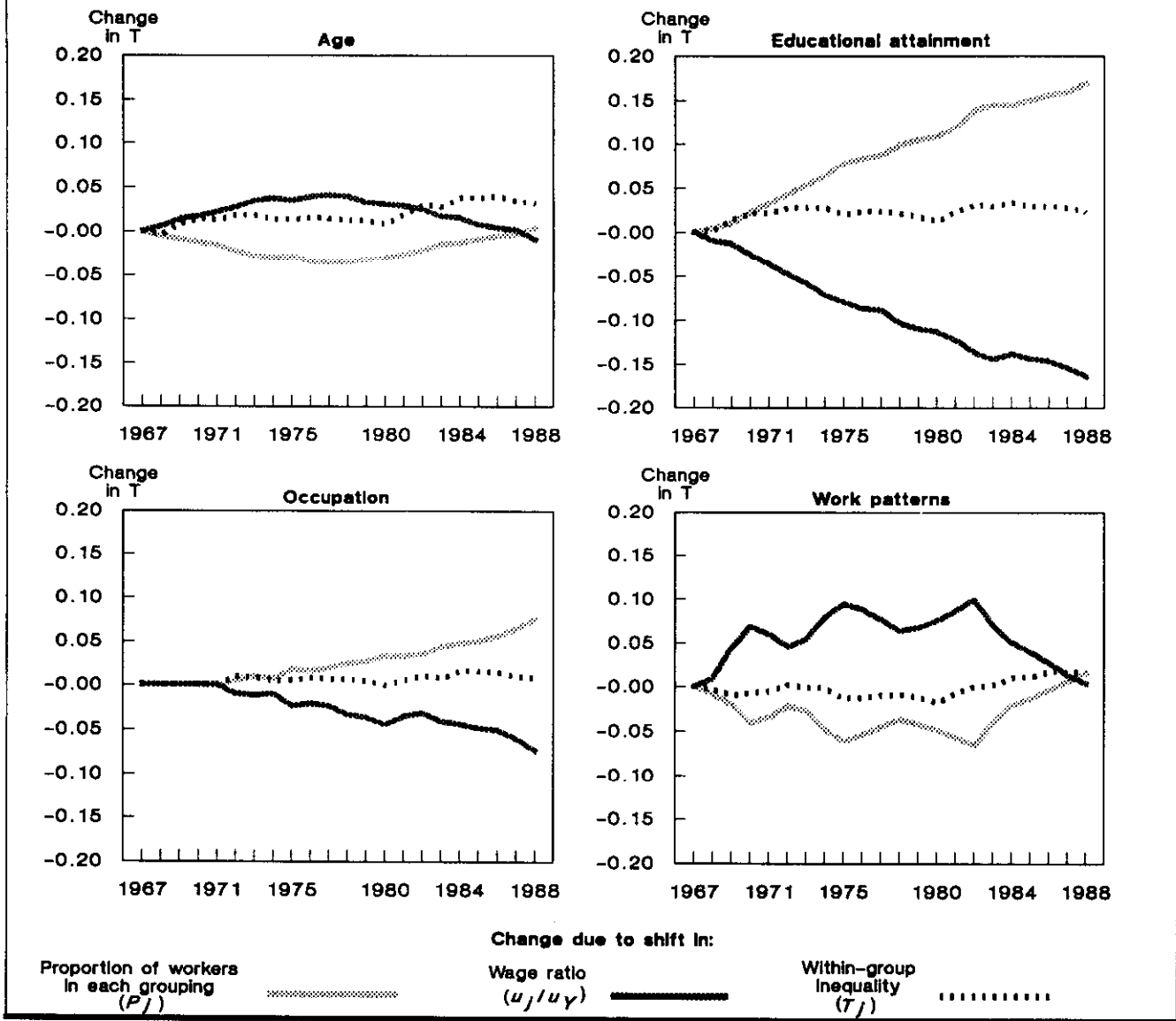
When we consider the effects of the three labor market variables together (in column 5 of table 3), about 55 percent of overall inequality between 1970 and 1977 was explained by differences among groups. There has been a steady decline in that share since 1977. This fraction is somewhat higher than the proportion explained by demographic variables, and the decline has not been so dramatic as the decline in share explained by demographic variables. We conclude, therefore, that labor market factors have become relatively more important than demographic factors in explaining inequality in wages and salaries.

Marginal effects of variables. While Theil's measure of inequality can be easily decomposed, it is not well suited for investigating the interaction of various factors. Nonetheless, it is important to understand these interactions; for example, the contributions of industrial structure and of occupational structure to overall inequality are likely to be interdependent, because changes in sectoral composition of the economy are likely to be accompanied by shifts in occupational composition.

To determine the independent contribution of each factor, the marginal effect of the factor was calculated by comparing among-group inequality when six factors are considered with the among-group Theil coefficients when five factors are included. (In these calculations, race and ethnicity are omitted, because their influences on overall inequality prove to be so small.) The difference corresponds to the additional among-group inequality due wholly to the excluded factor. These marginal effects, reported in table 4, are analogous to partial derivatives with the effects of other variables held constant, while the total effects reported in tables 2 and 3 are analogous to total derivatives.

The marginal effect of each variable is considerably less than the total effects reported in tables 2 and 3. Not surprisingly, this indicates substantial interaction among the various factors. The net effects of the demographic variables—age, education, and gender—for the most part confirm our earlier conclusions. While the age composition of the labor force increased among-group inequality

Chart 1. Cumulative changes in the Theil coefficient T, by component, attributable to workers' age, educational attainment, occupation, and work patterns, 1967-88

Change due to shift in:

Proportion of workers in each grouping (P_j)	Wage ratio (u_j/u_Y)	Within-group Inequality (T_j)

through 1974, among-group differences have accounted for a fairly stable part of inequality since then. The marginal effect of differences arising from educational levels was virtually unchanged until 1985; since then, there has been a modest increase. The contrast between the stable marginal effect of education and its increasing total effect between 1974 and 1986 (from table 2) indicates that educational changes have been correlated with other shifts, particularly occupational trends and changes in gender shares as more well-educated women have entered the la-

bor force. The marginal effects of gender are quite small and stable, in contrast to its total effects. Overall, these demographic factors contribute very little to explaining the increase in inequality.

Of course, one problem with the calculation of marginal effects is that if several correlated variables change together, the marginal influence of each will be zero, and it will be difficult to detect the overall change by examining marginal effects alone. For example, the marginal effects of education are quite stable, at least until 1984, but the combined effects of shifts in educational attainment, occupa-

tion, and sectoral composition of the work force—as the differences between better educated and less well-educated individuals in high- and low-skilled positions became more pronounced, partly because of sectoral shifts—completely explain the increase in overall inequality during the 1980's. Thus, the contrast between marginal and average effects helps to identify those cases in which changes in inequality are due to a complex of related changes occurring simultaneously.

In contrast to the results for demographic variables, each labor market variable—sectoral composition, occupational structure, and work patterns of the labor force—increased its marginal contribution to inequality, particularly after 1980. These results also confirm that changes related to full-time and part-time work have the highest marginal effects; by themselves, they explain more of the increase in earnings inequality over the entire study period than any other variable, although their influence is greatest for the period 1970–76 and has been relatively stable during the 1980's. In general, the marginal effects shown in table 4 confirm our earlier conclusions based on total effects—that demand-side factors manifested in labor market variables are more important than are demographic variables in explaining inequality.

Conclusions

During the 1967–88 period, wages and salaries became more unequally distributed, with two spurts of increasing inequality (1967–72 and 1980–86), and a period of relative stability (with some cyclical variation) during most of the 1970's. As others have found, the patterns for men and women diverge, with increases in inequality sharper for men and with inequality among women declining during the 1970's, offsetting increases that took place during the late 1960's and the 1980's. We also detect a decline in inequality after 1986, a shift that would be particularly notable if it holds up in subsequent years.

One obvious conclusion about patterns of inequality, embedded in our methodology, is that changes in inequality are complex. Our measure of inequality—Theil's T—depends on the proportions of individuals in different groups, the dispersion of group mean earnings around the overall mean, and inequality within each group, and can be affected independently by all three. It is therefore insufficient to examine any one component—as commentators often do when they remark on the shift from manufacturing to services, for example, or the increases in proportions of women working outside the home, or the population shift from the Snowbelt to the Sunbelt. Furthermore, changes in certain factors are often related to changes in others, so that it is potentially misleading to examine only one or two variables; in our results, the differences between marginal and total effects of particular trends are striking.

A second conclusion is that the complex mechanisms that generate inequality are to some

Table 3. **Among-group Theil coefficients for selected labor market factors, 1967–88**

Year	Industry structure	Occupational structure	Work patterns	Industry, occupation, and work patterns	Share of inequality explained by labor market factors
1967	0.041	--	0.119	--	--
1968	.042	--	.120	--	--
1969	.045	--	.146	--	--
1970	.043	0.076	.145	0.199	0.556
1971	.044	.075	.144	.199	.556
1972	.041	.071	.145	.196	.540
1973	.040	.073	.149	.201	.554
1974	.040	.073	.142	.194	.540
1975	.041	.069	.149	.200	.559
1976	.043	.071	.151	.201	.558
1977	.043	.072	.149	.199	.553
1978	.039	.068	.146	.194	.545
1979	.039	.067	.144	.190	.541
1980	.039	.066	.144	.190	.548
1981	.042	.072	.147	.197	.547
1982	.045	.079	.148	.201	.540
1983	.045	.078	.147	.200	.540
1984	.043	.080	.152	.205	.542
1985	.044	.077	.147	.198	.528
1986	.043	.080	.144	.200	.529
1987	.042	.079	.141	.196	.527
1988	.043	.077	.134	.190	.518

extent offset by an interesting pattern tending to limit changes in inequality. The pattern evident in chart 1—with the effects of changing proportional representation of groups and changing earnings ratios having opposite signs, and tending to cancel one another out—suggests an equilibrating mechanism related to labor supply adjustments. For example, as a group with mean earnings close to the national average expands its representation in the labor force, tending to reduce inequality, its mean wages must fall in response to that expansion (assuming that demand for labor is stationary), tending to increase inequality through changing wage ratios. Conversely, any group with relatively high average earnings (which increase inequality) will have lower growth rates, and larger relative increases in numbers of lower-paid workers will tend to reduce inequality. Such mechanisms not only operate to moderate changes in inequality because they offset one another, but also mean that trends in within-group inequality—the T_j in the second term of equation (2)—tend to drive overall inequality. This is consistent with our observation that the within-group component of inequality is both large and increasing. Unfortunately, this finding frustrates the search for causes of inequality because within-group trends cannot be readily interpreted.

Can we find a culprit in these results on which to blame increasing inequality? It is possible to rule out some possible causes, of course. Changes in the racial and ethnic composition of the labor force are clearly too small to contribute much, and geographic shifts also prove not to explain increasing inequality. Furthermore, increases in the relative numbers of women in the labor force have generally decreased, rather than increased, inequality.

One conclusion is that characteristics of the periods of increasing inequality over the 1967–88 span were quite different; it is therefore fruitless to search for a single explanation for inequality. Between 1967 and 1972 (a subperiod for which occupational data are incomplete), changes in among-group variation accounted for about 69 percent of the increase in Theil's T. The increase in among-group variation during this period can be wholly accounted for by shifts related to age and work patterns.[47] The two are related, of course, because young workers usually enter a "youth labor market" characterized by more erratic employment patterns, frequent job shifts, and a greater incidence of part-time work.[48] In addition, the recession of 1969–70 may have exacerbated this pattern, because the cyclical behavior of inequality due to changes in work patterns confirms the importance of this particular recession.

For this early period, within-group variation

accounts for the remaining 31 percent of increasing inequality. By construction, there is no way to explain this increase with the variables we have used. However, it is possible to identify which groups had the highest increases in within-group inequality (T_j). They prove to include men; individuals with some high school or high school diplomas, and men (but not women) with 4 years of college; those aged 16 to 19; those working in construction, petrochemical and metal manufacturing, retail trade, and especially producer services; and those working more than full time. Unfortunately, it is difficult to see many clues in this list, especially because it includes both workers with marginal labor force attachment and those relatively high up in the earnings distribution.

The second period of increasing inequality, between 1980 and 1986, is in one sense the reverse of the earlier period: only 45 percent of the increase in inequality is due to changes among groups, while a majority—55 percent—is due to increases in inequality within groups. Changes related to educational levels and occupational shifts are primarily responsible, with changes in sectoral patterns of employment also contributing to this increase.[49] Again, these changes are related, because the shifts away from low educational levels and toward higher educational levels and the increasing dispersion of mean earnings at different educational levels are related to occupational changes, which are to some extent the same as sectoral shifts away from manufacturing and agriculture and toward producer services and health and education. (The fact that these changes are so interrelated helps to explain the large differences between the total effects in tables 2 and 3 and the marginal effects in table 4.) Thus, the inequality of the 1980's looks very much like the result of changes that have been cited in various commission reports, including greater diversity in the jobs available in the economy, and the expansion of highly skilled and well-paid jobs held by well-educated individuals while certain types of low-skilled and poorly paid work—mainly in retail trade and consumer services—expand as well.

However, it is impossible to explain the earnings inequality of the 1980's fully without accounting for rising within-group inequality, because that component contributes a majority of the increase. Here again, the best that our analysis can do is to identify those groups with the greatest growth in within-group inequality. While there were increases for almost all groups, they were highest among men; high school dropouts; those aged 16 to 19, 20 to 29, and over 65; and those working full-year, overtime and full-year, full-time. (No occupational or sectoral groups had especially high increases in within-group inequality.) Men and persons working full-year are

Marginal effects of demographic and labor market variables on among-group inequality, 1970–88

Year	Among-group Theil with six factors	Marginal contribution of—					
		Demographic factors			Labor market factors		
		Age	Education	Gender	Industry structure	Occupational structure	Work patterns
1970	0.254	0.025	0.021	0.017	0.022	0.024	0.047
1971	.256	.026	.021	.017	.022	.024	.048
1972	.254	.027	.021	.017	.023	.024	.049
1973	.259	.029	.022	.018	.024	.025	.050
1974	.253	.030	.020	.018	.023	.025	.048
1975	.258	.027	.021	.015	.023	.023	.054
1976	.258	.028	.021	.015	.023	.022	.055
1977	.257	.027	.020	.017	.022	.022	.053
1978	.253	.028	.021	.017	.022	.022	.053
1979	.245	.026	.020	.015	.022	.021	.052
1980	.244	.026	.020	.016	.022	.022	.055
1981	.253	.027	.021	.016	.025	.024	.055
1982	.258	.027	.021	.015	.025	.024	.057
1983	.256	.027	.021	.015	.025	.024	.058
1984	.263	.027	.021	.015	.024	.026	.059
1985	.258	.028	.024	.016	.025	.025	.058
1986	.258	.027	.023	.015	.025	.025	.057
1987	.254	.027	.023	.015	.025	.027	.059
1988	.251	.028	.025	.017	.030	.031	.057

generally considered mainstream members of the labor force, while high school dropouts and younger and older workers are often considered "marginal." Unhappily for those attempting to explain the patterns of the 1980's, large intragroup increases in earnings inequality appeared among very different groups.

What might explain these and other increases in intragroup inequality? Of course, it is always possible that our data are too crude, and that more detailed descriptions of worker groups would reduce the amount of unexplained variation. Of the substantive explanations that have been advanced,[50] increasing variation in the quality (rather than the quantity) of schooling is a plausible hypothesis, but only for those young workers (aged 16 to 29) with relatively high increases in within-group inequality, and not for the many other groups with moderate increases. Widening of interindustry wage differences is not a compelling explanation because, while such variation does account for a small part of the increasing inequality after 1980, its effects are analyzed independently in our results and are not included in intragroup differences. Increasing returns to unobserved skills remain a likely explanation; these could include returns to labor market experience— which differs substantially from age for individuals with histories of intermittent employment— and returns to on-the-job training, both of which are substantial in the labor markets of the 1980's.[51] In particular, a growing division between "careers" with stable employment, on-the-job training, and long-term earnings growth, and "jobs" with unstable employment and little on-the-job

training—in part, a difference in employment characteristics between the primary and the secondary labor markets—would show up only in within-group inequality. Finally, increases in intra-industry earnings differentials remain a plausible explanation, perhaps as differentials grow between large and small firms, or between primary firms—those with advanced technologies, high productivity, skilled workers, higher wages, and national and international markets—and peripheral firms.

What about the future? The evidence of a reversal in the long-term pattern of increasing inequality in 1987 and 1988 is tantalizing, although 2 years of evidence is far from being a trend (particularly with data subject to sampling variation). Certain changes that reduce inequality should continue to operate, particuarly the movement of women into the labor force and the narrowing of male-female earnings differences (although the pace of these changes may slacken), and the aging of the baby boom, which places this large cohort closer to the middle of the earnings distribution. However, the recession that began in July 1990 is likely to increase inequality; on the basis of preliminary CPS data, Ryscavage and Henle reported an increase in inequality in 1989, the year prior to the onset of the recession.[52] Moreover, the secular changes that seem to be responsible for the increase in inequality since 1980—differences among groups at various educational levels, and the correlated changes in occupational and sectoral composition of the work force—show no signs of abating. In addition, the finding that within-group contributions to inequality were growing

during the 1980's (despite declines in 1987 and 1988) is disconcerting; there are few clues to the causes of intragroup inequality, and such increases have been large among both mainstream and mar-

ginal groups of the labor force. Overall, then, the current concern over increasing earnings inequality is fully warranted, and deserves further analysis of its causes and possible solutions.　　□

Footnotes

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[1] See, for example, Frank Levy and Richard Murnane, "Earnings Levels and Earnings Inequality: A Review of Recent Trends and Proposed Explanations," *Journal of Economic Literature*, forthcoming.

[2] W. Norton Grubb and Robert Wilson, "Sources of increasing inequality in wages and salaries, 1960–80," *Monthly Labor Review*, April 1989, pp. 3–13.

[3] See Sheldon Danziger and Robert Plotnick, "Demographic change, government transfers, and income distribution," *Monthly Labor Review*, April 1977, pp. 7–11; Sheldon Danziger, Robert Haveman, and Peter Gottschalk, "How Income Transfer Programs Affect Work, Savings, and the Income Distribution," *Journal of Economic Literature*, September 1981, pp. 975–1028; and Isabel Sawhill, "Poverty in the U.S.: Why Is It So Persistent?" *Journal of Economic Literature*, September 1988, pp. 1073–119.

[4] Peter Henle and Paul Ryscavage, "The distribution of earned income among men and women, 1958–77," *Monthly Labor Review*, April 1980, pp. 3–10.

[5] The Current Population Survey (CPS) is a monthly survey of about 60,000 households selected to represent the Nation's population and designed to measure employment and unemployment. Each March, the CPS also collects information relating to the incomes and earnings of persons, families, and households in the previous calendar year. For more information, see any recent issue of the U.S. Bureau of the Census publication, *Current Population Reports, Consumer Income*, Series P-60.

[6] Bennett Harrison, Chris Tilly, and Barry Bluestone, "The Great U-Turn: Increasing Inequality in Wage and Salary Income in the U.S.," paper presented before the Joint Economic Committee of the U.S. Congress, January 1986.

[7] See Levy and Murnane, "Earnings Levels," table 4; and Paul Ryscavage and Peter Henle, "Earnings inequality accelerates in the 1980's," *Monthly Labor Review*, December 1990, pp. 3–16.

[8] Robert Plotnick, "Trends in Male Earnings Inequality," *Southern Economic Journal*, January 1982, pp. 724–32.

[9] Martin Dooley and Peter Gottschalk, "Earnings Inequality Among Males in the United States: Trends and the Effects of Labor Force Growth," *Journal of Political Economy*, vol. 92, no. 1, 1984, pp. 59–89.

[10] Gary Burtless, "Earnings Inequality Over the Business and Demographic Cycle," in Gary Burtless, ed., *A Future of Lousy Jobs?* (Washington, The Brookings Institution, 1990).

[11] See also Martin Dooley and Peter Gottschalk, "Does a younger male labor force mean greater earnings inequality?" *Monthly Labor Review*, November 1982, pp. 42–45.

[12] Chris Tilly, Barry Bluestone, and Bennett Harrison, "The Reasons for Increasing Wage and Salary Inequality, 1978–1984" (University of Massachusetts at Boston, John W. McCormack Institute of Public Affairs, February 1987).

[13] See Burtless, "Earnings Inequality"; and Levy and Murnane, "Earnings Levels."

[14] James P. Smith and Finis R. Welch, *Closing the Gap: Forty Years of Economic Progress for Blacks*, R-3330-DOL (Santa Monica, CA, The Rand Corporation, February 1986); and Michael Reich, "Postwar Racial Income Differences: Trends and Theories," in Garth Mangum and Peter Phillips, eds., *Three Worlds of Labor Economics* (Armonk, NY, Sharp, 1988).

[15] Saul Schwartz, "Earnings Capacity and the Trend in Inequality Among Black Men," *Journal of Human Resources*, Winter 1986, pp. 44–63.

[16] See James P. Smith and Michael P. Ward, *Women's Wages and Work in the Twentieth Century*, R-3119-NICHD (Santa Monica, CA, The Rand Corporation, February 1986); and Grubb and Wilson, "Sources of increasing inequality."

[17] Tilly, Bluestone, and Harrison, "The Reasons for Increasing Wage and Salary Inequality, 1978–1984."

[18] Grubb and Wilson, "Sources of increasing inequality."

[19] Burtless, "Earnings Inequality."

[20] Tilly, Bluestone, and Harrison, "The Reasons for Increasing Wage and Salary Inequality, 1978–1984."

[21] Bradley Rieff, "Industry and Occupation: Employment Structure and the Income Distribution" (Cambridge, MA, Massachusetts Institute of Technology, Department of Economics, 1986); and James L. Medoff, "The Structure of Hourly Earnings Among U.S. Private Sector Employers, 1973–1984" (Cambridge, MA, Harvard University and the National Bureau of Economic Research, December 1984).

[22] Grubb and Wilson, "Sources of increasing inequality."

[23] Lynn Karoly and Jacob Klerman have shown that intraregional differences (that is, the T_j) diverged during the 1980's after converging during the 1970's. (See Lynn Karoly and Jacob Klerman, "Regional Differences in Increasing Earnings Inequality," unpublished paper (Santa Monica, CA, The Rand Corporation, March 1991).) However, the contribution of regional shifts depends on the dispersion of regional means and changes in the population within each region, in addition to the intraregional variation, and so it is possible for T_j to diverge while the contribution of regional shifts to overall inequality is small. We will explore the regional changes more fully in a forthcoming paper.

[24] Grubb and Wilson, "Sources of increasing inequality."

[25] See Henri Theil, *Statistical Decomposition Analysis* (Amsterdam, North-Holland Publishing Co., 1972); and Paul Allison, "Measures of Inequality," *American Sociological Review*, December 1978, pp. 865–80.

[26] For comparisons of different measures of inequality, see Allison, "Measures of Inequality"; for comparisons of T with other measures of inequality, showing high correlations with other commonly used measures, see Grubb and Wilson, "Sources of increasing inequality," table A–1. In "A Study of the Distribution of Individual Earnings in the United States from 1967 to 1986," Ph.D. diss. (Yale University, Department of Economics, December 1988), Lynn Karoly has calculated different measures of inequality for the period 1967–86, as reported in Levy and Murnane, "Earnings Levels" (forthcoming), table 4, showing that trends during this period are quite similar no matter what measure is used.

[27] For an application of this methodology to the study of fertility, see Thomas W. Pullum, Lucky M. Tedrow, and Jerald R. Harting, "Measuring Change and Continuity in Parity Distributions," *Demography*, August 1989, pp. 485–98.

[28] When equation (3) is applied to annual data, the result is a Laspeyres index. Cumulating values of dT/dt calculated for 1-year changes is a much better approximation than calculating dT/dt over a 20-year period, for which the well-known bias of a Laspeyres index would be serious.

[29] In the text of this article, the year refers to year of the earnings data, which is the year before the March survey. The data used in this project come from *Current Population Survey, Annual Demographic File* (Bureau of the Census). Computer files for the survey years 1968 through 1985 were the uniform series of March Current Population Survey files created under the direction of Robert D. Mare, University of Wisconsin, and Christopher Winship, Northwestern University. For survey years 1986–88, computer files were obtained from the Inter-university Consortium for Political and Social Research (ICPSR), Ann Arbor, MI. The valid cases in these files vary from a low of 58,901 in 1969 to 83,586 in 1980.

[31] The top-codes of the CPS are handled by fitting a Pareto distribution to the upper earnings groups. Some of the individuals with zero earnings undoubtedly were involuntarily unemployed the entire year, and their zero earnings should be included. However, as there is no way to distinguish those involuntarily unemployed in the CPS data, we exclude all those with zero earnings, and our estimates should be interpreted as lower bounds on inequality.

[32] We interpret work patterns as the result of labor demand, even though individuals may choose to work different amounts of time, because a great deal of part-time work is involuntary and thus demand-related, and because the trends in work patterns are clearly cyclical and therefore demand- rather than supply-driven.

[33] We note that the increase in inequality between 1968 and 1969 was especially sharp. Part of the explanation may be that the number of individuals classified as nonworkers decreased by about 500 between 1968 and 1969, representing about 1 percent of the sample of 58,901. (These cases also were classified as having no occupation and were excluded from the 1967 and 1968 calculations.) These excluded cases were predominantly female, part-time workers with low wages. Therefore, the CPS recoding of similar cases in 1969 and later years could account for a small part of the increase in the Theil coefficient between 1968 and 1969. However, the increase in the Theil for men and the substantial increase for women between 1969 and 1970 should not have been affected by any possible recoding. In addition, the pattern of increasing inequality we find during the late 1960's is consistent with other research results. We conclude, therefore, that the patterns we find for the late 1960's could not be qualitatively affected by any recoding.

[34] In particular, our earlier results using decennial census data show an increase in inequality for men between 1969 and 1979 and a slight decline for women, consistent with the CPS results in table 1. However, there are some differences between the census and CPS figures: the increase for men is greater using census data, so that overall inequality increases between 1969 and 1979 while the CPS data show a small overall decline.

[35] Ryscavage and Henle, "Earnings inequality accelerates."

[36] Karoly, "A Study of the Distribution of Individual Earnings."

[37] The roughly 30 percent of inequality due to within-group variation is much smaller than that reported in other studies. Levy and Murnane, "Earnings Levels" (forthcoming), table 6, having compared four different studies with varying controls, find from 51 percent to 73 percent of variation explained by within-group differences. In part, this is because these studies have concentrated on demographic variables, rather than the labor market variables that we find so powerful.

[38] Because data on occupations are missing for 1967–69, the decomposition among groups defined by all six variables can begin only with 1970. However, decomposition among groups defined by all of these except occupation extends back to 1967, and indicates increases only in among-group components between 1967 and 1969.

[39] Of the increase in T of 0.031 between 1980 and 1986, 0.017, or 55 percent, was due to within-group increases, and the remaining 0.014 to increases in among-group variation; contrast columns 3 and 4 of table 1 with column 1.

[40] See Robert Hauser and David Featherman, "Equality of Schooling: Trends and Prospects," *Sociology of Education*, 1976, pp. 99–120.

[41] Grubb and Wilson, "Sources of increasing inequality."

[42] See Gary Burtless, "Earnings Inequality."

[43] Grubb and Wilson, "Sources of increasing inequality."

[44] This describes the marginal increase of the among-group Theil coefficient when race and ethnicity are added to the other six factors. See the section on the marginal effects of demographic and labor market variables later in this article.

[45] Advanced technology sectors are based on the third definition of high-tech sectors, those that both use technology-oriented workers and have high research and development expenditures, developed in Richard Riche, Daniel Hecker, and John Burgan, "High technology today and tomorrow: a slice of the employment pie," *Monthly Labor Review*, November 1983, pp. 50–58.

[46] See Grubb and Wilson, "Sources of increasing inequality," for detailed results to corroborate these and other patterns.

[47] The increase in the overall T is 0.026 between 1967 and 1972. The increase in the among-group Theil is also 0.026 when groups are defined by both age and work patterns, and the increase in within-group inequality is zero.

[48] Paul Osterman, *Getting Started: The Youth Labor Market* (Cambridge, MA, The MIT Press, 1986).

[49] Of the increase in the among-group component of T of 0.014 during this period (table 1, column 5), an increase of 0.020 can be accounted for by educational changes (in table 2), an increase of 0.019 by education and occupation, of 0.018 by education, occupation, and sectoral group, and of 0.013 by occupation and sector. (The last three figures come from unpublished decompositions by various combinations of variables.) The marginal contribution to increasing inequality of each of these is low (or even negative), even though each independently contributes to inequality over this period.

[50] These are summarized in Levy and Murnane, "Earnings Levels," section IV.

[51] See W. Norton Grubb, "The Varied Economic Returns to Postsecondary Education: New Evidence from the Class of 1972," *Journal of Human Resources*, forthcoming.

[52] Ryscavage and Henle, "Earnings inequality accelerates."

APPENDIX: Variable definitions

Following are the variables used in the foregoing analysis of trends in earnings inequality, and the range of possible values they could assume.

A. **Age**
   (Age last year)

   1   16 to 19 years
   2   20 to 29 years
   3   30 to 39 years
   4   40 to 64 years
   5   65 years and older

B. **Gender**

   1   Male
   2   Female

C. **Educational attainment**

   1   Elementary school (0 to 8 years)
   2   Some high school (9 to 11 years)
   3   High school graduate (12 years)
   4   Some college (13 to 15 years)
   5   Four years of college (16 years)
   6   More than 4 years of college (17 years or more)

D. **Race and ethnicity**

   1   White (non-Spanish)
   2   Black
   3   Spanish (nonblack)
   4   Other

E. **Industry**

   (1980 census codes)

   1   Agriculture   010–050

   2   Construction   060

   3   Nondurable
       manufacturing   100–102 110–112
                            120–122 130 132
                            140–142 150–152
                            160–162 171 172
                            220–222
                  and
       Miscellaneous durable
       manufacturing   230–232 241 242
                            250–252 261 262
                            340 350 390–392

   4   Petrochemical
       manufacturing   180 182 190 191
                            200 201 210–212
                  and
       Metal manufacturing 270–272 280–282
                            290–292 300 301
                            310–312 320 331
                            332 351 360 361
                            370

   5   Advanced technology 181 192 321 322
                            341 342 352 362
                            371 372 380–382

   6   Distributive services 400–402 410–412
                            420–422 432 440–
                            442 460-462 470–
                            472
                  and
       Wholesale trade   500–502 510–512
                            521 522 530–532
                            540–542 550–552
                            560–562 571

   7   Retail trade   580–582 590–592
                            600–602 610–612
                            620–622 630–632
                            640–642 650–652

   8   Producer services   700–702 710–712
                            721 722 730–732
                            740–742 881 882
                            890-892

   9   Consumer services   750–752 760–762
                            770–772 780–782
                            790 791 800–802
                            862 870–872 880

   10 Health and education 812 820 822 830–
                            832 840–842
                            850–852 860 861

   11 Public administration 900 901 910 921
                            922 930–932

F. **Occupation**

   (1980 census codes)

   1   Management   003–009 013–019
                            023–029 033–037

   2   Professional   043–049 053–059
                            063–069 073–079
                            083–089 095–099
                            103–106 113–119
                            123–129 133–139
                            143–149 153–159
                            163–169 173–179
                            183–189 193–195
                            197–199

   3   Technical   203–208 213–218
                            223–229 233–235

   4   Sales   243 253 259
                            263–269 274
                            275 277 278
                            283–285
                            (NOTE. 276,
                            cashiers, moved to
                            Clerical)

   5   Clerical   276 303–209
                            313–319 323
                            325–329 335–339

		343–349 353–357	9	Operative	703–709 713–715
		359 363–366 368			717 719 723–729
		369 373–379			733–739 743–745
		383–387 389			747–749 753–759
6	Service	403–407 413–418			763–766 768–769
		423–427 433–439			773–774 777 779
		443–449 453–459			783–787 789
		463–469			793–799 803–806
7	Farming	473–477 479			808–809 813 814
		483–489 494–499			823–826 828 829
8	Craftworker	505 505 509			833 834 843–845
		514–519 523 525–			848 849 853 855
		527 529 533–536			856 859 863–867
		538 539 543 544			869 873 875–878
		547 549 553 558			833 885 887–889

6   Service
403–407 413–418
423–427 433–439
443–449 453–459
463–469

7   Farming
473–477 479
483–489 494–499

8   Craftworker
505 505 509
514–519 523 525–
527 529 533–536
538 539 543 544
547 549 553 558
563–567 569 573
575–577 579
583–585 587–589
593–599 613–617
633–637 639
643–647 649
653–659 666–669
673–679 683 684
686–689 693–696
699

9   Operative
703–709 713–715
717 719 723–729
733–739 743–745
747–749 753–759
763–766 768–769
773–774 777 779
783–787 789
793–799 803–806
808–809 813 814
823–826 828 829
833 834 843–845
848 849 853 855
856 859 863–867
869 873 875–878
833 885 887–889

G. **Work pattern**
(Time worked last year)

0   Overtime (overtime last week and full-time full-year last year)
1   Full-year, full-time
2   Full-year, part-time and part-year, part-time
3   Part-year, full-time