Sources of increasing inequality in wages and salaries, 1960-80

Intersectoral employment shifts appear to be much more important than regional and demographic shifts in the increase in inequality; however, the trend seems to be driven chiefly by developments within labor force groups, rather than movements among them

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Interest in the distribution of income waxes and wanes. Concern intensified during the 1960's with the "rediscovery" of poverty and the initiation of the War on Poverty. It diminished during the 1970's, as other economic difficulties commanded the Nation's attention. Evidence that the distribution of income had been relatively stable during the post-World War II period tended to make the issue even less pressing.

During the 1980's, however, distributional questions have become more prominent. According to some analysts, evidence has accumulated that the distributions of income and earnings have become more unequal. The possible consequences—increasing poverty, more demands on government programs, a growing underclass, the decline of the middle class, political instability, a generation of children with inadequate education—would be serious, and would affect almost every public and private institution in the country.

An overview

In examining inequality, it is important to distinguish inequality among individuals from inequality among families or households, which is affected by marriage, separation or divorce, and changes in labor force participation, as well as inequality among individuals; and earnings must be distinguished from income, which includes government transfers. In this article, we explore changes in the distribution of one important component of total income—the pretax wages and salaries of individuals—between 1960 and 1980,[1] using data from the decennial census. The strategy we take is similar to that of other researchers—to examine a series of possible explanations of increasing inequality, rejecting some as unimportant and finding others responsible for some part of increases in inequality.

Many previous analyses have concentrated on the earnings distributions among men or have compared men and women.[2] To develop a broader analysis, we examine the effects of both gender and race on the distribution of wages and salaries. The effects of gender are of particular interest, because the increasing labor force participation of women during the study period, together with the generally lower earnings of women compared to men, could increase overall inequality.

In addition, most analyses have concentrated on national patterns. However, the two decades chosen for study were periods of important sectoral and regional shifts—from manufacturing to services, and from the Snowbelt to the Sunbelt—which increased employment

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in low-wage positions and could be responsible for increasing inequality. Therefore, we examine the potential effects of regional and sectoral employment shifts.[3]

Finally, we use a measure of inequality—one developed by Henri Theil, which we refer to as Theil's T—that is in several ways superior to the conventional measures of inequality (such as the Gini coefficient and the variance of log income), especially in its decomposition properties.

Decomposing patterns of inequality

One substantial and much-discussed change in the U.S. economy that might explain any deterioration of the earnings distribution involves sectoral composition. If, as is sometimes claimed,[4] well-paid manufacturing positions have been replaced by poorly paid positions in the service sector, then the distribution of earnings might have become more unequal. Alternatively, because high paying industries (often those heavily unionized) tend to show less variation in earnings,[5] it may be that the decline in unionized heavy manufacturing has caused a shift from sectors with greater equality of wages to sectors with greater inequality. For this study, the sectors were chosen to differentiate among various types of manufacturing and service sectors.[6] A high-tech sector is included, defined as those industries that employ technology-oriented workers and that have high research and development expenditures.[7]

The second major change involves employment shifts among regions—from the Northeast and North Central States to the southern tier of States—that has focused so much attention on the friction between the Snowbelt and the Sunbelt. Shifts *among* regions—from regions with high wages to those with low wages, or from regions of lesser inequality to those of greater inequality—may be responsible for changes in earnings patterns, rather than changes *within* regions. Both sectoral and regional shifts may be due partly to endogenous processes; for example, the mobility of employers in search of low wages means that wage patterns affect regional changes, which in turn generate greater inequality. Similarly, the relative decline of high-wage manufacturing—because of the export of production to overseas locations, or the cost advantages of firms already located in low-wage nations—describes a process whereby low-wage sectors in this country grow at the expense of high-wage sectors, potentially aggravating inequality.

In addition to analyzing distributions by sector and region, we also differentiate between men and women because the employment of women has increased so much since World War II and because their earnings patterns have been quite different from those of men. Finally, we distinguish between racial groups, again because of the possibility that racial patterns diverge.[8] Because of limitations in the data available, we examine distributions for blacks and nonblacks; the latter group includes whites, Asian-Americans, a small number of American Indians, and most Hispanics.[9]

The method we use involves calculating inequality within and among groups. In our analysis, then, we have 2 genders, 2 races, 14 sectors, and either 9 census regions or 51 States (including Washington, DC), for a possible total of 2,856 groups. The only data set with enough observations to permit this many groupings and still allow us to calculate within-group inequality is the decennial census. Examining other possible explanations of inequality would increase the number of groups beyond the limits of even the census data.

The reference years of the census data—1959, 1969, and 1979—were all years of economic expansion, though they differ because they occurred at different stages of their respective expansions. According to a 1980 analysis of data from the Current Population Survey (CPS) by Peter Henle and Paul Ryscavage, inequality in these years was not seriously affected by purely cyclical patterns,[10] and the results obtained by Sheldon Danziger and Peter Gottschalk with decennial census data and with annual CPS data are consistent.[11] Therefore, we can be reasonably sure that patterns in the census data are due to secular trends and not merely to cyclical events. (Later, we plan to replicate our results with annual CPS data, to examine cyclical variation and to analyze trends since 1979.)

We examine wage and salary income for all those with nonzero earnings during the census year, rather than total earnings (which include wages, salaries, and self-employment income). By analyzing wages and salaries rather than total earned income, we concentrate on the consequence of employment decisions by firms. Inequality in total earnings is greater than inequality in wages and salaries, but the patterns of the two are similar.[12] There has been no marked trend in the relative importance of the two components of total earnings: wages and salaries were 90.2 percent of total earnings in 1969, 91.5 percent in 1979, and 92.6 percent in 1983.

Most studies of income inequality have used the Gini coefficient, the variance of the log of income, the coefficient of variation, or some measure based on fractiles of the income distribution. We have chosen to use a measure of inequality developed by Henri Theil, based on information theory.[13] The measure is:

$$(1) \qquad T = 1/n \; \Sigma (Y_i/u_Y) \log (Y_i/u_Y)$$

$$= 1/n \; \frac{\Sigma (Y_i \log Y_i) - (u_Y \log u_Y)}{u_Y}$$

where u_Y refers to the mean of earnings Y. The second of the expressions clarifies that T is the dispersion of $Y_i \log Y_i$ around its mean, standardized by the mean. Theil's measure is scale invariant, so that it is unaffected by inflation.

It also adheres to the principle of transfers—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 can be shown to depend on log (Y_2/Y_1); thus, a transfer of $100 from someone with an income of $6,000 to one with an income of $5,000 decreases T as much as a transfer of $1,000 from someone earning $60,000 to a person earning $50,000. If we assume diminishing marginal utility of income, this is a desirable property. Finally, T is bounded from below by zero, when everyone has the same income; at the other extreme, when 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 n is appropriate, because a society of 1,000 people in which one person has all the income is more unequal than a two-person society in which one person has all 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.[14]

Aside from simplicity of calculation, another advantage of Theil's 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:

$$(2) \qquad T = \Sigma (p_j u_j/u_Y) \log (u_j/u_Y) + \Sigma (p_j u_j/u_Y) T_j$$

where p_j is the proportion of individuals in the jth group, u_j is the mean income for the jth group, u_Y is the overall mean, and T_j is Theil's T for the jth group.[15] The first term on the right is the among-group variation, and increases with the dispersion of average group incomes u_j around the overall mean u_Y. The second term is the within-group variation, a function of T_j's, suitably weighted; this term can also be expanded to show the contribution of individual groups—for example, specific sectors—to overall inequality.

This decomposition makes it clear that inequality is affected by three factors: (1) The proportion of the population in different groups, particularly as there are shifts to higher (or lower) proportions in groups with greater inequality T_j, or higher proportions in groups with means u_j that are far from the overall mean u_Y. An example would be an employment shift from States near the national average to States with relatively high or low income averages. (2) Inequality within groups. As the individual T_j's increase, overall inequality increases as well. (3) Increasing variation of the group means u_j around the overall income mean u_Y.

Changes in inequality between two years—for example, $T_{80} - T_{70}$—can be expressed as changes in among-group inequality plus changes in within-group inequality. Such changes can be further decomposed into changes in the proportions in different groups, P_j; changes in the dispersion of group incomes around the national mean u_j/u; and changes in the group specific inequality measured by T_j.[16] However, as there are three distinct components of inequality, such an approach becomes tedious.[17] To understand the causes of changing inequality, it is easier to simulate what inequality would have been if only certain changes had taken place—for example, what inequality would have been if there had been mobility among regions but the regional income distributions themselves had stayed constant.[18] It is also straightforward to forecast inequality under different assumptions, such as further increases in women working (assuming male-female earnings patterns remain constant), or a continued shift from manufacturing to services.

In our analyses, there are a maximum of 2,856 groups, defined by gender, race, sector, and State. Keeping these groups separate allows us to examine all possible interactions of these four characteristics of individuals; for example, we can examine not only changes in inequality due to regional shifts, but also whether these changes are due to shifts in the sectoral composition within the region rather than changes within sectors. For each of these groups, we also calculated other commonly used measures of inequality as a check on T.[19] (To compare Theil's T with other measures of the earnings distribution, an appendix presents correlation coefficients between T and various measures, calculated across the 2,856 groupings, for 1980.) The results of this check reveal that Theil's T behaves appropriately, compared to better-known measures.

One immediate finding of importance is that, contrary to results of some earlier work suggesting that inequality was stable during the 1960's and increasing during the 1970's, inequality in wages and salaries increased both during the 1960's—with Theil's T rising from 0.351 to 0.374—and again between 1970 and 1980, with T rising to 0.392. (See table 1.) Evidently, the worsening of inequality in pretax earnings has been occurring for longer than most observers have recognized, masked by changes in transfer payments and in family composition.

Patterns by gender and race

Our basic results for the four gender-race groups are presented in table 1. One obvious change between 1960 and 1980 is that women increased their rates of labor force participation; in 1960, women were 37.8 percent of the labor force in our sample, increasing to 45 percent by 1980. Over this period, the ratio of women's earnings to those of men increased slightly, from 44.9 percent to 47.7 percent. More remarkable, however, is the fact that inequality among men increased steadily, especially for nonblack

men, while inequality among women decreased somewhat. In 1960, women's earnings were considerably more unequal than those of men (T = 0.364 versus 0.296); by 1980, inequality was virtually identical (T = 0.335 for women and 0.330 for men).

Earnings patterns by race have diverged substantially between men and women. In 1960, black men earned an average of 55.5 percent as much as nonblack men. By 1980, this had increased to 68.0 percent, though this may partially reflect an increasing proportion of Hispanic men included among those considered nonblack, rather than any equalization of white and black male earnings.[20] For women, however, a dramatic equalization of earnings took place: while black women earned 60.5 percent as much as nonblack women in 1960, mean earnings of these two groups were essentially identical by 1980. There was also a convergence of inequality: while earnings of black women were substantially more unequal than those of other women in 1960—with a correspondingly higher proportion of low earners—these measures of inequality were essentially identical in 1980. The tendency for these racial differences to disappear for women, though definitely not for men, apparently is due to the fact that black women have managed to move out of the occupations to which they were traditionally restricted—especially as domestic workers—into a broader range of occupations similar to those of white women; in addition, the greater numbers of Hispanic women among nonblack women workers may be partly responsible.

Overall, therefore, inequality in earnings *among* these four gender-race groups fell between 1960 and 1980, from 0.072 to 0.064. This decrease has several sources: the slight narrowing of male-female differences; the vanishing difference between black and nonblack women; and a particular interaction—the fact that employment was increasing among women just as male-female differences were narrowing slightly. In contrast, the inequality explained by within-group variation increased from 0.279 to 0.328. Much of this was due to increasing inequality among nonblack men, but the increasing share of nonblack women with relatively high (though declining) within-group inequality also contributed substantially to increasing inequality.

The results on low earnings in table 1 are also interesting. (Low earners are defined as those whose wages and salaries are less than the Federal poverty standard for a family of three.) Although the Theil increased during this period, the proportion of low earners decreased by 2 percentage points between 1960 and 1970 (from 34.8 percent to 32.8 percent), and then increased during the 1970's to 33.8 percent. The trends in low earnings vary by race and gender. While the proportion of low earners was rather stable for nonwhite men, decreasing slightly during the 1960's and increasing during the 1970's, it fell markedly for black women (from 75.5 percent to 45.6 percent), substantially for black men (from 40.0 percent to 31.4 percent), and slightly for nonblack women (from 51.5 percent to 47.1 percent). There is, then, some convergence in the proportions of low earnings, and this helps explain

Table 1. Components of the distribution of wages and salaries by race and gender, 1960, 1970, and 1980

Year and worker category	Mean income	Ratio of mean income to total mean income	Proportion of earners	Theil's T	Portion of T accounted for by variation—		Percent of total within-group variation by worker group	Proportion low income earners in group
					Among groups	Within groups		
1960								
Total	$3,599.25	1.000	1.000	0.35104	0.07225	0.27879	100.00	0.348
Men:								
Nonblack	4,741.42	1.317	.564	.25820	—	.19188	68.83	.211
Black	2,630.65	.731	.057	.26201	—	.01097	3.93	.400
Women:								
Nonblack	2,145.50	.596	.333	.34507	—	.06853	24.58	.515
Black	1,297.65	.361	.045	.45246	—	.00741	2.66	.755
1970								
Total	5,836.18	1.000	1.000	.37398	.07067	.30331	100.00	.328
Men:								
Nonblack	7,812.86	1.339	.533	.29072	—	.20752	68.42	.208
Black	4,922.46	.843	.049	.25444	—	.01062	3.50	.291
Women:								
Nonblack	3,476.29	5.96	3.72	.34604	—	.07664	25.27	.477
Black	2,947.94	.505	.045	.37127	—	.00853	2.81	.557
1980								
Total	11,641.91	1.000	1.000	.39175	.06143	.32762	100.00	.338
Men:								
Nonblack	15,678.82	1.347	.500	.32594	—	.21964	67.04	.223
Black	10,665.48	.916	.050	.30458	—	.01387	4.23	.314
Women:								
Nonblack	7,251.44	.623	.399	.33636	—	.08368	25.54	.471
Black	7,331.21	.630	.051	.32776	—	.01043	3.18	.456

the falling contribution of among-group variation to overall inequality.

In these results, racial patterns make little difference to changes in overall inequality, simply because blacks are such a small and constant proportion of the labor force. The patterns among blacks are interesting in their own right, and the convergence of earnings between black women and nonblack women is particularly striking. However, there simply are not enough blacks to affect the overall distribution of earnings substantially, and therefore increasing inequality must arise from some other source.

Another way to examine changes in inequality is to calculated a set of Theil's measures for hypothetical changes. In terms of equation *(2)* above, we can calculate T's under the assumption that only the composition of the labor force p_j changes, without earnings patterns for groups changing; under the assumption that only the mean income ratios u_j/u_Y change; under the assumption that only the within-group inequality as measured by T_j changes; or under the assumption that any two of these change. Table 2 presents the results of calculating such hypothetical T's. (Components of T that do not change are held constant at 1960 levels.) The first row indicates that changes in the racial and gender composition of the labor force would, by themselves, have caused inequality to *decrease*. This surprising result is linked to increases in the proportion of women working; because Theil's T is more sensitive to changes in low earnings than in high earnings, replacing high-earning nonblack men with low-earning nonblack women causes inequality to fall. However, changes in earnings means and changes in within-group inequality each caused increases in inequality, as expected. Together, changes in earnings and patterns would have increased T to 0.45, and then shifts in the composition of the labor force reduced T to its actual value, 0.392. Thus, changing patterns of earnings, rather than changes in the composition of the labor force, are responsible for the overall increase in inequality.

Based on these results, the finding of increasing inequality in wages and salaries should be qualified to reflect the differences among population groups. Increasing inequality is the most striking for nonblack men, precisely the group for which most analysis has been done, and there are also increases in inequality for black men. But for women, and especially for black women, there has been a tendency for inequality to decrease. Overall, however, gender and race explain a declining proportion of inequality, and so we must look for other explanations for the deterioration of the earnings distribution between 1960 and 1980.

Table 2. Theil's T for 1960 and 1980, and as recalculated for 1980 using hypothetical changes

Item	Base-year T	With hypothetical change in— Employment shares	Earnings ratios	Within-group T's	Earnings ratios and within-group T's	End-year T
4 race-gender groups, 1960–80	0.351	0.298	0.404	0.399	0.450	0.392
9 census regions, 1960–80	.351	.344	.350	.396	.394	392
14 sectors:						
1960–80	.351	.378	.330	.399	.370	.392
1960–70	.351	.382	.314	.389	.349	.374
1970–80	.374	.373	.382	.388	.396	.392
4 race-gender groups, 14 sectors, and 51 States:						
1960–80	.351	.321	.368	.407	.422	.392
1960–70	.351	.354	.337	.389	.374	.374
1970–80	.374	.339	.403	.395	.424	.392

Earnings patterns by region

We can examine regional sources of inequality by examining either States or the nine census regions. Table 3 presents the results for census regions, which are easier to interpret than similar results by State. For 1960, very little of earnings inequality can be explained by among-region differences—only 2.4 percent of the Theil of 0.351. Furthermore, inter-region variation falls markedly by 1970 and 1980, to 0.6 percent of inequality in the latter year. When States are the units of analysis, 0.0126 of the 1960 Theil of 0.351 (or 3.6 percent) is explained by inter-State variation, again falling markedly to 0.0045 of the Theil of 0.392 (or 1.1 percent) by 1980. Thus, inequality is largely intra-regional or intra-State, rather than reflecting differences among regions or States.

The results in table 3 indicate that northern regions and the West have higher average earnings and lower inequality, but the table also confirms substantial convergence among regions in two dimensions of earnings. Mean earnings have converged; for example, regional means relative to the national mean ranged from 0.75 to 1.125 in 1960, but only from 0.869 to 1.078 by 1980. In addition, variation within regions, as measured by the regional Theil's, have also converged: in 1960, the region with the greatest inequality (East South Central) had a T of 0.407, while the region with the least inequality (the Mid-Atlantic) had a T of 0.307. By 1980, regional inequality ranged between 0.376 and 0.405. The same pattern of convergence is evident when we examine States rather than census regions: State mean incomes relative to the national mean ranged between 0.565 (Mississippi) and 1.20 (Connecticut) in 1960, but fell within the range of 0.785 (Mississippi) to 1.12 (Connecticut) in 1980[21]; the range of State T's is 0.287 to 0.496 in 1960, but 0.345 to 0.444 in 1980. Of course, there is some stability in the ranking of mean earnings and inequality over time, for both States and census regions, but the most salient finding is simply that

States and regions are becoming more similar to each other in patterns of earnings.

With regard to the contribution of various regional changes to overall inequality, it is again clear from table 2 (row 2) that within-region inequality, rather than employment shifts among regions, is responsible for the changes between 1960 and 1980. Mobility among regions—reflected in table 3 by the relative increase in employment in the Mountain and Pacific regions, and the relative declines in the New England, Mid-Atlantic, and East North Central regions—changed inequality very little, from 0.351 to 0.344, because inequality among regions was small in 1960 in any case, and because increase in population shares occurred for both high-income and low-income States and regions. Similarly, the convergence in regional mean earnings by itself left inequality virtually unchanged (from 0.351 to 0.350). When these 1960–80 changes are examined by decade, mobility made a slightly greater contribution to increases in inequality during the 1960's and shifts in regional earnings were slightly more important in the 1970's. The increases in inequality *within* regions, however, are far more important, and account for virtually all of the increase in inequality between 1960 and 1980.

These results confirm the declining significance of region in the distribution of wage and salary income. Differences among regions and among States have narrowed considerably since 1960, and, in any event, these differences explain very little of national inequality. These results suggest that regional patterns can be ignored in the analysis of national inequality.

Contribution of sectoral shifts

Table 4 presents results for earnings in 14 economic sectors. Variation among sectors explains a more substantial fraction of overall inequality—13.7 percent in 1960 and 9.0 percent in 1980—than does variation among regions. Still, among-sector variation declines over time, both absolutely and relatively, while the contribution of within-sector inequality increases steadily. The sector that contributes the most to the increase in national inequality is the high-tech sector, simply because the numbers of workers employed in this sector increased from 2.0 percent of the labor force in 1960 to 4.7 percent in 1980; producers' services, in which there were substantial increases in employment (from 7.1 percent to 10.1 percent) and in inequality; and in health and education, where again both employment and inequality increased substantially.

Average earnings vary among sectors in well-known ways, and are lowest in consumer services and retail trade and highest in the high-tech sector and distributive services. Inequality varies among sectors as well: those sectors with relatively few low earners—high-tech, distributive services, and machinery—tend to have relatively low inequality, while agriculture, retail trade, and consumer services all have high proportions of low earners and high levels of inequality. Contrary to the conventional image of the high-tech sector as one with great inequality because it consists of a few highly paid professionals and many poorly paid assemblers, this sector has relatively low inequality. The reason is that high-tech has only half the proportion of low earners as the average sector; the conventional depiction of this sector does not take into account the large number of jobs with very low pay in consumer services, retail trade, and agriculture.

As in the case of regions, there is evidence of some convergence among sectors in patterns of earnings. Sectoral means relative to the national average ranged from 0.510 to 1.57 in 1960, but from 0.615 to 1.38 in 1980; inequality within sectors ranged between 0.155 and 0.635 in 1960, but between 0.205 and 0.515 in 1980. Sectors are still remarkably different in 1980, of course, but this tendency toward convergence implies again that among-sector inequality is decreasing while within-sector inequality is increasing.

In fact, inequality increased between 1960 and 1980 within every sector except agriculture and consumer services. The increase was especially sharp in health and education, with much greater increases in inequality for men than for women (as is true in general, of course). The other sectors with substantial increases in inequality include construction, petrochemicals, high-tech, producers' services, and public administration—all with above-average employment of skilled workers or well-trained professionals and below-average proportions of low earners. Conversely, the two sectors with falling inequality—agriculture and consumers' services—hire a great deal of low-skilled labor, and have above-average proportions of low-wage labor. This suggests a hypothesis for subsequent examination: that changes in inequality within sectors are related to the use of highly-skilled or well-educated labor and to the wages and salaries paid these workers.

Unlike regional shifts, which explain little of the increasing inequality between 1960 and 1980, sectoral changes did have some influence on inequality. Shifts in employment among sectors—out of agricultural, nondurable manufacturing, and miscellaneous durable manufacturing to high-tech sectors, producers' services, and health and education—would, by themselves, have accounted for a substantial part of the increase in inequality between 1960 and 1980, with employment changes increasing T from 0.351 to 0.378. (See table 2, row 3.) Results for each decade are also reported in table 2, and it is clear that these sectoral shifts were particularly important in increasing inequality in the 1960's but not during the 1970's. The convergence in earnings ratios among sectors substantially reduced inequality in the 1960's but made a slight contribution to increased inequality in the 1970's. During both decades, the single most important contribution to increased total inequality was the increase

Table 3. Components of the distribution of wages and salaries by census region, 1960, 1970, and 1980

Year and region	Mean income	Ratio of mean income to total mean income	Proportion of earners	Theil's T	Portion of T accounted for by variation— Among groups	Portion of T accounted for by variation— Within groups	Percent of total within-group variation by worker group	Proportion low income earners in group
1960								
Total	$3,599.25	1.000	1.000	0.35104	0.00837	0.34267	100.00	0.348
New England	3,627.53	1.008	.062	.32513	—	.02041	5.96	.315
Mid-Atlantic	4,008.29	1.114	.200	.30666	—	.06819	19.90	.274
East North Central	3,963.12	1.101	.199	.32349	—	.07099	20.72	.306
West North Central	3,281.81	.912	.08[illegible]	.37834	—	.02808	8.20	.397
South Atlantic	3,072.64	.854	.144	.38289	—	.01830	13.78	.411
East South Central	2,683.61	.746	.060	.40658	—	.04723	5.34	.474
West South Central	3,057.75	.850	.089	.40576	—	.03079	8.99	.437
Mountain	3,426.04	.952	.038	.35962	—	.01295	3.78	.383
Pacific	4,047.51	1.125	.125	.32445	—	.04573	13.34	.310
1970								
Total	5,836.18	1.000	1.000	.37398	.00489	.36910	100.00	.328
New England	5,907.29	1.012	.064	.36882	—	.02373	6.43	.324
Mid-Atlantic	6,462.40	1.107	.187	.35083	—	.07261	19.67	.277
East North Central	6,244.08	1.070	.204	.35060	—	.07664	20.76	.306
West North Central	5,283.75	.898	.079	.40818	—	-.02896	7.85	.386
South Atlantic	5,321.42	.912	.148	.37583	—	.05060	13.71	.341
East South Central	4,771.04	.817	.057	.36759	—	.01710	4.63	.373
West South Central	5,119.12	.877	.088	.39980	—	.03097	8.39	.375
Mountain	5,285.69	.906	.040	.40173	—	.01452	3.93	.382
Pacific	6,317.91	1.083	.133	.37378	—	.05397	14.62	.317
1980								
Total	11,641.91	1.000	1.000	.39175	.00223	.38952	100.00	.338
New England	11,291.07	.970	.058	.39988	—	.02265	5.81	.346
Mid-Atlantic	12,287.30	1.055	.160	.37740	—	.06385	16.39	.314
East North Central	12,329.56	1.059	.188	.37581	—	.07494	19.24	.324
West North Central	10,730.99	.922	.077	.40010	—	.02838	7.28	.375
South Atlantic	10,909.50	.937	.161	.39425	—	.05946	15.26	.344
East South Central	10,115.75	.869	.060	.38683	—	.02001	5.14	.371
West South Central	11,273.63	.968	.101	.40482	—	.03968	10.19	.349
Mountain	11,109.09	.954	.051	.39302	—	.01906	4.89	.361
Pacific	12,552.53	1.078	.144	.39729	—	.06150	15.79	.324

in *within*-sector inequality. Indeed, increasing within-sector inequality by itself would have increased T to 0.399, and thus the convergence of average earnings (which decreases inequality) and the shifts among sectors (which increase inequality) approximately offset each other. These results illustrate how the three components of overall inequality can behave in different ways, and indicate that sectoral changes have several different, and partially offsetting, influences on inequality.

To some extent, these findings appear to justify fears about "deindustrialization": The employment shifts from manufacturing to services have made the distribution of earnings in this country more unequal, particularly between 1960 and 1970. However, a more pervasive finding is that inequality has increased within almost all sectors, especially in those with well-trained or highly educated workers.

Interactions among groups

The census data permit us to examine any combination of race, gender, region (or State), and sector and, therefore, the interactions among these groups can be examined. Table 5 presents some figures for several interactions, describing among-group and within-group sources of inequality between 1960 and 1980. Of course, the sources of among-group inequality are not additive. For example, according to tables 1, 3, and 4, inequality among 4 race-gender groups in 1980 was 0.064, among 9 census regions was 0.002, and among 124 sectors was 0.035, summing to 0.101—somewhat greater than the actual inequality among the 504 race-gender-region-sector groupings of 0.092.

However, the results in table 5 add little to those presented earlier. Even for the most detailed figures, describing variation among and within 2,856 groups classified by sector, State, race, and gender, among-group inequality accounted for only 24 percent (.095/.392) of overall inequality in 1980, having declined from 32.8 percent (.115/.351) in 1960. Therefore, within-group inequality is responsible for the majority of inequality and for the increases in inequality between 1960 and 1980.

These results also demonstrate that different components of change affect inequality differently. The national discussion of regional and sectoral shifts, for example, has concentrated on changes in employment, but the convergence in mean earnings—which by itself decreased inequality (in rows 2 and 4 of table 2)—along with the

increases in within-sector and within-region inequality have been less frequently mentioned. Both trends in mean incomes and in within-group inequality have increased overall inequality (row 6 of table 2), while the changing composition of employment—specifically, gender and racial changes—have decreased inequality. The causes of trends in inequality are complex, and the decomposition of Theil's T helps clarify these complexities.

Conclusion and future directions

These results have confirmed with detailed census data what others have found using Current Population Survey data: overall inequality in wages and salaries increased between 1960 and 1980. However, this increase was not evenly spread throughout the population. Inequality has gone up among men (especially nonblack men), but has actually decreased among women (especially black women). Contrary to expectations, changes in the gender and racial composition of the labor force—especially the increasing proportions of women working—by themselves *decreased* earnings inequality, while changes in the earnings distributions—particularly the increasing inequality among nonblack men—more than offset these changes.

Again contrary to expectations, regional shifts explain almost none of the changing inequality. There was instead a marked convergence among regions, so that differences

Table 4. Components of the distribution of wages and salaries by sector, 1960, 1970, and 1980

Year and sector	Mean income	Ratio of mean income to total mean income	Proportion of earners	Theil's T	Portion of T accounted for by variation—		Percent of total within-group variation by worker group	Proportion low income earners in group
					Among groups	Within groups		
1960								
Total	$3,599.25	1.000	1.000	0.35104	0.04815	0.30290	100.00	0.348
Agriculture	2,172.82	.604	.056	.63529	—	.02129	7.03	.664
Construction	4,164.58	1.157	.065	.24022	—	.01794	5.92	.234
Nondurable goods	3,535.16	.982	.116	.32200	—	.03679	12.14	.308
Petrochemicals	5,451.16	1.515	.026	.18114	—	.00708	2.34	.113
Machinery	5,143.94	1.429	.065	.15507	—	.01430	4.72	.103
Miscellaneous durable goods	3,737.82	1.038	.039	.27103	—	.01091	3.60	.272
Technological industries	5,635.63	1.566	.020	.15635	—	.00501	1.65	.093
Distributive services	4,746.50	1.319	.089	.16807	—	.01982	6.54	.145
Wholesale trade	4,652.92	1.293	.039	.30667	—	.01529	5.05	.223
Retail trade	2,520.24	.700	.162	.46199	—	.05234	17.28	.520
Producer services	4,321.93	1.201	.071	.35504	—	.03032	10.01	.272
Consumer services	1,834.25	.510	.097	.56801	—	.02812	9.28	.666
Health and education	3,257.17	.905	.107	.33803	—	.03280	10.83	.375
Public administration	4,496.54	1.249	.049	.17860	—	.01088	3.59	.167
1970								
Total	5,836.18	1.000	1.000	.37398	.03983	.33416	100.00	.328
Agriculture	4,154.24	.712	.035	.58555	—	.01455	4.35	.499
Construction	7,267.37	1.245	.057	.25873	—	.01834	5.40	.202
Nondurable goods	5,462.92	.936	.087	.35935	—	.02931	8.77	.301
Petrochemicals	7,307.31	1.252	.016	.24669	—	.00479	1.43	.175
Machinery	7,868.03	1.348	.078	.18418	—	.01945	5.82	.122
Miscellaneous durable goods	6,151.90	1.054	.037	.29600	—	.01157	3.46	.234
Technological industries	8,056.64	1.380	.052	.21442	—	.01546	4.63	.132
Distributive services	7,298.17	1.251	.077	.20110	—	.01932	5.78	.165
Wholesale trade	7,389.55	1.266	.042	.33400	—	.01795	5.37	.219
Retail trade	3,668.62	.629	.155	.52461	—	.05117	15.31	.555
Producer services	6,804.58	1.166	.084	.41281	—	.04025	12.05	.281
Consumer services	3,306.30	.567	.079	.57089	—	.02552	7.64	.598
Health and education	5,188.64	.889	.150	.38672	—	.05160	15.44	.375
Public administration	7,292.43	1.250	.051	.23428	—	.01489	4.45	.190
1980								
Total	11,641.91	1.000	1.000	.39175	.03537	.35638	100.00	.338
Agriculture	10,706.53	.920	.032	.49426	—	.01474	4.13	.388
Construction	13,128.93	1.128	.059	.30950	—	.02070	5.81	.259
Nondurable goods	11,076.20	.951	.068	.35581	—	.02290	6.43	.316
Petrochemicals	14,790.86	1.270	.015	.26489	—	.00489	1.37	.189
Machinery	15,835.04	1.360	.070	.20530	—	.01948	5.47	.144
Miscellaneous durable goods	11,672.99	1.003	.032	.31555	—	.01027	2.88	.272
Technological industries	15,921.25	1.368	.047	.23064	—	.01483	4.16	.150
Distributive services	16,088.10	1.382	.071	.20782	—	.02047	5.74	.155
Wholesale trade	14,567.88	1.251	.042	.35766	—	.01883	5.28	.232
Retail trade	7,305.39	.628	.169	.51489	—	.05471	15.35	.567
Producer services	12,809.31	1.100	.101	.42197	—	.04674	13.11	.298
Consumer services	7,158.82	.615	.071	.49392	—	.02146	6.02	.555
Health and education	10,626.20	.914	.168	.45545	—	.06997	19.63	.367
Public administration	13,517.81	1.161	.055	.25811	—	.01640	4.60	.223

NOTE: See text footnote 6 for detailed definitions of sectors.

among regions and therefore inequality among regions—were of diminishing importance. This finding, which holds whether we examine 9 census regions or 51 States, seems so robust that regional patterns—which are expensive to examine in terms of data requirements—can be ignored in subsequent analyses of inequality.

However, sectoral shifts—the much debated increase in services and high-tech employment at the expense of agriculture and manufacturing—were, as hypothesized, partly responsible for increasing inequality. By themselves, changes in the sectoral composition of employment accounted for almost two-thirds of the overall increase in Theil's T between 1960 and 1980—but these effects were augmented by even larger increases in inequality within most sectors, and offset somewhat by a tendency for mean wages and salaries among sectors to converge. Aside from indications that inequality has increased most in sectors with high skill and education levels, the results do not suggest why inequality has increased within sectors.

Our findings so far are similar to those of earlier researchers: we have eliminated some potential explanations of increasing inequality, such as regional shifts and changes in the numbers of women working, and confirmed the importance of sectoral shifts, but much of the recent increase in inequality remains unexplained. Two potential explanations merit further attention. Occupational patterns may be important, particularly because of the tantalizing finding that the sectors with the greatest increases in inequality are those with more highly skilled or highly educated workers. Changing patterns of part-time and part-year employment, which Chris Tilly, Barry Bluestone, and Bennett Harrison have cited and which Saul Schwartz found important to increasing inequality among black men,[22] might explain why inequality has increased so consistently within sectors and within regions, and why it has increased for men but decreased for women.

Table 5. Sources of inequality in wage and salary income for selected labor force groupings, 1960, 1970, and 1980

Labor force group	1960		1970		1980	
	Among groups	Within groups	Among groups	Within groups	Among groups	Within groups
14 sectors by 2 gender groups	0.097	0.254	0.092	0.282	0.085	0.307
9 census regions by 4 race-gender groups	.079	.272	.075	.299	.066	.325
14 sectors by 9 census regions	.056	.295	.045	.329	.039	.353
14 sectors by 9 census regions by 4 race-gender groups	.110	.241	.101	.273	.092	.300
14 sectors by 51 States by 4 race-gender groups	.115	.236	.105	.269	.095	296
Overall inequality	.351	—	.374	—	.392	—

There is nothing in our results to diminish the importance of the issue, however. Indeed, inequality in wages and salaries has been increasing for nonblack men for longer than most observers have thought. Nothing in these results indicates that the trend of inequality will abate; to the contrary, for men (especially black men) and for several sectors (health and education, and construction), the increase in inequality was greater during the 1970's than during the 1960's. The conclusion that increasing inequality within various groups and sectors is responsible for most of the increasing inequality—rather than well-known shifts among sectors and regions and changes in the composition of the labor force—adds to the importance of further analysis, for the reasons behind within-group developments remain poorly understood.

FOOTNOTES

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[1]In this article, we are interested in the fundamental shifts in the economy underlying inequality, rather than with changes in household demographics and transfer programs; therefore we confine our analysis to individuals and to wages and salaries rather than total income.

[2]See, for example, Martin Dooley and Peter Gottschalk, "Does a Younger Male Labor Force Mean Greater Earnings Inequality?" *Monthly Labor Review*, April 1977, pp. 7–11; Martin Dooley and Peter Gottschalk, "Earning Inequality among Males in the United States: Trends and Effects of Labor Force Growth," *Journal of Political Economy*, February 1984, pp. 59–89; Peter Henle and Paul Ryscavage, "The Distribution of Earned Income Among Men and Women, 1958–1977," *Monthly Labor Review*, April 1980, pp. 3–10; Robert Plotnick, "Trends in Male Earnings Inequality," *Southern Economic Journal*, January 1982, pp. 724–732; and Saul Schwartz "Earnings Capacity and the Trend in Inequality Among Black Men," *Journal of Human Resources*, Winter 1986, pp. 44–63.

[3]Among other possible explanations for trends in inequality that appear to have little influence, and that we therefore do not consider here, are changes in the age and experience of at the labor force; cyclical variation in unemployment; and changes in the educational composition of the labor force. In addition to the references in footnote 2, see also Bradley Reif, "Industry and Occupation Employment Structure and Income Distribution" (Massachusetts Institute of Technology, May 1986); and Chris Tilly, Barry Bluestone, and Bennett Harrison, "What is Making American Wages More Unequal?" (Boston College, December 1986). In subsequent analyses with both Census and CPS data, we plan to consider the effects of part-time versus full-time employment and education in addition to gender and sectoral composition.

[4]Robert Kuttner, "The Declining Middle," *Atlantic Monthly*, July 1983.

[5]See Carl B. Barsky and Martin E. Personick, "Measuring wage dispersion: pay ranges reflect industry traits," *Monthly Labor Review*, April 1981, pp. 35–41.

[6]For purposes of this analysis, sectors were defined as follows:

Agriculture, forestry, fishing, and mining (010–050)

Construction (060)

Nondurable, nonchemical manufacturing: food and kindred products (100–130), textile products and apparel (132–152), paper and allied products (132–152), printing and publishing (171–172), and leather and leather products (220–222)

Chemicals, petrochemicals, and plastics: chemicals and allied products (180–192, except 181 and 192), and petroleum, coal, rubber, and plastics (200–212)

Metal, machinery (except electrical), *and transportation equipment:* metal industries (270–301); machinery, except electrical (310–332, except 321 and 322); and transportation equipment (351–370, except 352 and 362)

Miscellaneous durable goods: lumber, wood products, stone, glass, clay, and concrete (230–262); electrical machinery except high-tech (340–350, except 341 and 342); and miscellaneous (390–392)

Advanced technology sectors (181, 192, 321–322, 341–342, 352, 362, 371–382)

Distributive services (400–472)

Wholesale trade (500–571)

Retail trade (580–691)

Producer services: finance, insurance, and real estate and business and professional services (700–742, 881–892)

Consumer services: repair; household and personal services; and social services (750–802, 862–880)

Private-sector health and education (812–861)

Public administration (900–932)

The census codes in parentheses are taken from *Census of Population and Housing: 1980: Public Use Microdata Sample—Technical Documentation* (Bureau of the Census, March 1983), appendix H, pp. 142–48. 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 W. Riche, Daniel E. Hecker, and John U. Burgan, "High technology today and tomorrow: a small slice of the employment pie," *Monthly Labor Review*, November 1983, pp. 50–58.

[7]See Riche and others, "High technology today and tomorrow."

[8]For example, James P. Smith and Finis R. Welch found convergence of the wages of black and white men between 1940 and 1980 in *Closing the Gap: Forty Years of Economic Progress for Blacks*, R-3330-DOL (Santa Monica, CA, The RAND Corporation, February 1986). Michael Reich argued that the pattern of narrowing racial differentials during the 1960's has been replaced by a growing differential for men during the 1970's in "Postwar Racial Income Differences: Trends and Theories" (University of California at Berkeley, October 1985). For women, the convergence in average earnings between whites and blacks has been even more marked than for men, and in fact the black-white differential has almost vanished, according to 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, October 1984).

[9]The census definition of Hispanics was not consistent over the years 1960, 1970, and 1980.

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

[11]See Sheldon Danziger and Peter Gottschalk, "How Have Families with Children Been Faring?" report presented to the Joint Economic Committee of the U.S. Congress, November 1985.

[12]Henle and Ryscavage, "The distribution of earned income."

[13]Henri Theil, *Economics and Information Theory* (Amsterdam, North-Holland Publishing Co., 1967).

[14]For comparisons of different measures of inequality, see Paul Allison, "Measures of Inequality," *American Sociological Review*, December 1978, pp. 865–80.

[15]See Henri Theil, *Statistical Decomposition Analysis* (Amsterdam, North-Holland Publishing Co., 1972); and Allison, "Measures of Inequality."

[16]For such a decomposition of the variance of log income, see Bradley Reiff, "Industry and Occupation Employment Structure and Income Distribution" (Cambridge, MA, Massachusetts Institute of Technology, May 1986).

[17]Because the proportions p_j and income ratios u_j/u_Y enter both terms of equation (2), the decomposition of changes in T involves several complex interaction terms. This does prove to be a drawback of using Theil's T rather than the variance of the log of earnings, for which the decomposition is more tractable.

[18]For an application, see Theil, *Economics and Information Theory*.

[19]In the census data files, earnings are given in $10 intervals, so that the problem of underestimating inequality because of ignoring inequality within large earnings intervals—as is necessary with published census data—does not arise. However, there is always an open-ended earnings group—those above $25,000 of earnings in 1960, $50,000 in 1970, and $75,000 in 1980. For those very few individuals in these open-ended categories, we followed the standard procedure of fitting a Pareto distribution to the upper 30 percent of the earnings distribution to estimate the mean earnings for this group.

[20]See Michael Reich, "Postwar Racial Income Differences."

[21]In these comparisons, we eliminate Alaska, which is an outlier with values of 1.20 in 1960 and 1.413 in 1980.

[22]See Chris Tilly, Barry Bluestone, and Bennett Harrison, "What Is Making American Wages More Unequal?" unpublished paper (Boston College, December 1986); and Schwartz, "Earnings Capacity."

APPENDIX: Theil's *T* compared to other measures

As indicated in the text, for each gender-race-sector-State group, we calculated not only the mean and Theil's T of wages and salaries, but also other commonly used measures of inequality—the Gini coefficient and the proportions of earnings going to the bottom 5 percent and 20 percent and to the top 5 percent and 20 percent of earners as a check on T. These fractiles also allow us to calculate the fraction of earnings going to the middle 60 percent of earners—one measure of the middle of the distribution, and therefore relevant to the thesis of the "vanishing middle." In addition, we also calculate a measure of low earnings; the proportion of earners whose wages and salaries are under the Federal poverty standard for a family of three. (Over a very large number of observations the Gini coefficient is very time-consuming to calculate, and so we have not calculated Gini coefficients for the country.)

To give some sense of the magnitude of Theil's T compared to the Gini coefficient, table A-1 presents both measures for sectors in California in 1980. To compare Theil's T against other measures of the earnings dis-

Table A-1. Pearson correlation coefficients for various inequality measures, 1980

Measure	Theil's *T*	Gini coefficient	Percent low earners	Bottom 5 percent	Bottom 20 percent	Middle 60 percent	Top 20 percent	Top 5 percent
Theil's *T*	1.00000	0.96072	0.59459	-0.38677	-0.60264	-0.68233	0.71588	0.29841
Gini coefficient	—	1.00000	.58359	-.32686	-.55793	-.57601	.61353	.13654
Percent low earners	—	—	1.00000	-.40965	-.56526	-.41552	.45563	.31355
Bottom 5 percent	—	—	—	1.00000	.74437	.47081	-.27236	-.39858
Bottom 20 percent	—	—	—	—	1.00000	.57895	-.33960	-.44869
Middle 60 percent	—	—	—	—	—	1.00000	-.99429	-.92078
Top 20 percent	—	—	—	—	—	—	1.00000	.86501
California								
Agriculture	.429	.489	—	—	—	—	—	—
Construction	.297	.410	—	—	—	—	—	—
Nondurable goods	.318	.417	—	—	—	—	—	—
Petrochemicals	.247	.372	—	—	—	—	—	—
Machinery	.236	.361	—	—	—	—	—	—
Miscellaneous durable goods	.310	.414	—	—	—	—	—	—
High-technology industries	.181	.320	—	—	—	—	—	—
Distributive services	.196	.323	—	—	—	—	—	—
Wholesale trade	.320	.416	—	—	—	—	—	—
Retail trade	.415	.503	—	—	—	—	—	—
Producer services	.392	.465	—	—	—	—	—	—
Consumer services	.478	.506	—	—	—	—	—	—
Health and education	.534	.516	—	—	—	—	—	—
Public administration	.163	.279	—	—	—	—	—	—

NOTE: See text footnote 6 for detailed definition of sectors.

tribution, the table also presents correlation coefficients between *T* and various measures, calculated across the 2,856 groupings, for 1980. The correlation between *T* and the Gini coefficient is very high, at 0.96; the Spearman rank order correlation is even higher, at 0.99. Theil's *T* is correlated about equally with the proportion of earnings held by the top and bottom tails of the earnings distribution. The correlation between *T* and the middle 60 percent of the distribution is negative, indicating that a declining middle would indeed increase inequality as measured by *T*. In sum, Theil's *T* appears to behave appropriately when compared to other measures of inequality.