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THE EFFECTS OF TECHNOLOGICAL CHANGE ON EARNINGS AND INCOME INEQUALITY IN THE UNITED STATES

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ABSTRACT

This paper explores the relationship between technological change and inequality in the U.S. since the late 1960's. The analysis focuses primarily on studying patterns and trends in the dispersion of various distributions of earnings and income during this recent period of rapid technological progress. We review relevant literature and perform several empirical analyses using microdata from the March Current Population Surveys from 1968 to 1986. Our main findings are that there is little empirical evidence that earnings inequality, measured across individual workers, has increased since the late 1960's, and even less evidence to support the hypothesis that any changes that have occurred have resulted from the effect of technological change on the demand for labor. However, we do find evidence of an increase since the late 1960's in the inequality of total family income, measured across families. Moreover, much of the increase appears to be due to changes in family composition and labor supply behavior, suggesting that the main effects of recent technological change on inequality have been supply-side in nature.

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I. Introduction

Although technological progress has always been an important feature of the American economy, the introduction and diffusion of new technologies has proceeded at an especially rapid pace during the past two decades. Production technologies are being powerfully affected by the development of microprocessors and microcomputers, automated production processes, lasers and satellite communications equipment, and data handling and information systems. These and other changes are fundamentally transforming the nature of traditional workplaces, as well as leading to the emergence of new work environments. Important academic and policy issues relating to the impact of technological progress on employment and unemployment, on labor productivity, and on earnings levels are being raised as a by-product of the changing nature of work. The impact of recent technological changes on the distribution of income has also been the focus of much recent discussion.

In his Presidential Address to the American Economic Association in 1954, Simon Kuznets set out what has become a classic analysis of the relationship between technological change and the distribution of income. Historically, according to Kuznets, technological change promoted industrial growth, which lead to an increase in labor demand in the industrial sector and a corresponding increase in the ratio of wages in industrial employment to wages in agricultural employment. Rising industrial wages induced a flow of workers from the low-wage agricultural sector to the high-wage industrial sector, initially leading to increased income inequality. As industrialization proceeded, however, and the industrial sector comprised a larger and larger proportion of total employment, further growth of that sector actually caused inequality to fall. Thus, the Kuznets curve -- an

inverted U-shaped curve -- reflects the tendency of inequality to rise and then fall as industrialization proceeds. Insofar as the U.S. is sufficiently industrialized to be situated on the declining portion of the Kuznets curve, one might think that further technological progress would tend to decrease income inequality.

The main problem one faces in trying to apply the Kuznets model to the recent economic history of the U.S. is that the model focuses exclusively on the transformation of an economy from one that is dominated by agriculture to one that is dominated by industry. In contrast, the central feature of recent employment changes in the U.S. has been the growth of employment in the service-producing industries. Since World War II, the U.S. economy has experienced two major employment shifts: (1) up through the mid-1960's there was a shift in employment from agriculture to services, with the share of manufacturing employment holding constant, and (2) from the late 1960's to the early 1980's, there was a shift in employment from the manufacturing sector to the service sector (see Urquhart, 1984). This latter shift is associated with relatively rapid technological change in manufacturing industries. These facts regarding postwar changes in the structure of employment in the U.S. suggest that it may not be sensible to apply the Kuznets curve to recent U.S. experience.

A provocative discussion of the contemporary relationship between technological change and income inequality, which places great emphasis on the underlying nature of recent technological change, has been offered by Wassily Leontief (1982, 1983). According to Leontief, technological change during a period of industrialization essentially involves machines taking over many of the physical activities that are traditionally performed by

people. Since people are still needed to perform mental functions, their productivity, and consequently their wages, remain high during periods of industrialization. However, the chief characteristic of recent technological advances is that machines are increasingly taking over mental functions previously performed by individuals. Thus, Leontief fears that income inequality will increase in the future because obsolete labor will not be able to secure productive employment.

Leontief's prediction that the diffusion of modern technology will lead to increased income inequality is arguable on several counts. First, Leontief's assessment of the labor market effects of technological change is not necessarily accurate. Industrial engineers commonly argue that complex equipment is most productively used when operated by individuals who are permitted and encouraged to exercise independent thought to make strategic interventions in production processes. Insofar as machines are still greatly inferior to humans in terms of the flexibility of their responses to different situations, the demand for labor will remain strong. In other words, the declining need for labor to perform certain routine mental functions may ultimately be offset by an increasing need for labor to solve problems that are not routine in nature.

Second, Leontief's (implicit) model applies closely to the manufacturing sector of the economy but pays little attention to the service sector. Over the past 2 decades, productivity gains in manufacturing have been sizable, presumably reflecting the rapid pace of technological progress in that sector. During the same period, the share of the labor force employed in manufacturing industries has declined significantly, but this decline has not been associated with significant increases in technological

unemployment. Rather, it is associated with an increase in service employment, a sector of the economy that has demonstrated great absorptive ability.

Finally, Leontief's discussion fails to specify the way in which technological change leads to increased income inequality. If technological change results in lower labor productivity, wage levels will tend to fall and, at least in the short run, unemployment will tend to rise. Whether increased inequality is a further result of these changes depends on a variety of other -- very basic -- factors, including the uniformity of the wage and employment effects across the economy, the wage and employment structure in the economy, and the flexibility of the labor market. These factors all interact to determine whether technological progress acts to increase income inequality, or to decrease it. Insofar as Leontief does not specify the assumptions he makes about these factors, his assertions are difficult to assess.

Despite its weaknesses, Leontief's analysis does highlight an important fact, namely, that understanding the nature of technological change is critical to assessing its social and economic impacts.

The purpose of this paper is to analyze trends in both income and earnings inequality over the past two decades and to explore their association with technological progress. This task is complicated by several factors. First, technological progress is a complex notion that potentially subsumes an extraordinarily wide variety of specific advances. It makes little sense to think of technological progress as a single variable. Different technological changes can have different impacts on labor markets, with correspondingly big differences in their effects on

labor productivity, labor income, and income dispersion. Second, there appears to be no set of easily measured and easily interpreted variables that satisfactorily reflect the nature and importance of particular technological changes, and certainly not of aggregate technological change. Third, technological change is only one of many factors that lead to changes in income inequality. Our ability to isolate the influence of technological change on income inequality is quite limited by well-known difficulties involved in building a statistical model that controls for the "correct variables" in the "correct way."

Given these problems, we confine ourselves in this paper largely to a descriptive analysis in which we measure changes in income and earnings inequality over the past two decades, a period of time during which technological change has been so substantial that it has been termed a "second industrial revolution." Whether any changes in inequality that occurred over that period are the direct result of technological change is not the focal point of our analysis. For example, we will not attempt to determine how much income inequality there would be today if there had been more or less technological change during the past 10 years. We will, however, lay out a simple economic framework that provides some clues about the nature of the inequality measures one might like to calculate and compare in order to learn about the relationships between technological change and income and earnings inequality. It is important to stress at the outset, however, that the effect of technological change on income and earnings inequality is indeterminate in a general theoretical sense, largely because technological change can affect the structure of labor demand and of labor supply in a variety of ways.

In brief, we find little empirical evidence of an association between technological change and earnings inequality since the late 1960s. In contast, there is evidence of a positive association between technological change and family income inequality, which is likely reflective of the effect of technological change on the size, structure, and labor supply behavior of American families.

The plan of this paper is as follows. In Section II, we present estimates of a variety of measures of inequality for the years 1967-1985. In Section III, we discuss a simple economic model of the effect of technological change on income inequality. Previous empirical literature is critically reviewed in Section IV. In Section V, we present a detailed analysis of trends in individual earnings inequality in the U.S., with emphasis on the analysis of earnings inequality within industries and of the effect of sectoral shift on overall earnings inequality. Section VI presents an analysis of changes in the dispersion of income across family units. Section VII summarizes the main results of the paper and discusses the principal conclusions.

II. Preliminary Evidence

Before discussing the theoretical linkages between technological development and the distribution of income, we present evidence concerning the extent and nature of changes in income inequality in the U.S. over the years 1967 to 1985. Our source of data is the public use samples of the March Current Population Surveys for the years 1968 to 1986. Each of these surveys contains data on a representative sample of U.S. households, with

information on social, economic, and demographic characteristics of all household residents, including their income and earnings in the year preceding the survey. A more complete discussion of the data is provided later in the paper.

A basic issue that arises in all empirical work on income inequality involves the formulation of an operational definition of the term "distribution of income." We stress this point early, since much of the interpretation of the evidence we present focuses on variations in the underlying concepts defining a distribution of income. Many of the conflicting conclusions reached by different studies in this area are explained by differences in the particular distribution of income that is analyzed.

In this paper, we wish to draw a sharp distinction between two concepts of the income distribution. One is the distribution of total family income across families. For every family in a particular year's sample, we compute a single income statistic that is the sum of the incomes of all members of the family. The sources of income included are earnings, interest and dividend income, and government cash transfers (i.e., this statistic does not account for noncash transfers or tax obligations). We then measure the cross-family dispersion of these incomes. Both Census families (two-or-more related persons living together) and unrelated individuals (individuals living alone or with other individuals to whom they are not related) are included in our definition of the family. This distribution is usually viewed as being closely related to a distribution of economic well-being, although it does not account for important differences across families such as the number of family members. [1]

The second distribution on which we focus is the distribution of earnings across individuals. Only income reported as being the direct result of work-related activity is included in this distribution. Also, only those individuals reporting that they worked at some time in the year preceding the survey are included in the population. [2] In contrast to the distribution of total family income, families with more than one earner will be represented more than once in the earnings distribution, while families with no earners will not be represented at all. This distribution most closely corresponds to a distribution of job/wage opportunities present in the labor market. It is related to a distribution of well-being because earnings is the main component of income, but this relationship is less close than the relationship between the total family income distribution and well-being, since the earnings distribution does not include non-labor income and does not account for sharing of resources within families. As a result, the dispersion of these two distributions need not move in the same direction over time.

We measure dispersion of these two distributions in two ways. First, we compute a Gini coefficient, a standard measure of inequality that is a positive function of the degree of inequality. Second, we classify each income unit (i.e., family or individual) into one of five income (or earnings) classes based on the relationship of each unit's income to the median level of income. The classes are defined as follows:

(1) lower class (LC) - income less than or equal to 60 percent of the median income;

(2) lower-middle class (LMC) - income greater than 60 percent but less than or equal to 100 percent of the median;

(3) middle class (MC) - income greater than 100 percent but less than or equal to 160 percent of the median;

(4) upper-middle class (UMC) - income greater than 160 percent but less than or equal to 225 percent of the median;

(5) upper class (UC) - income greater than 225 percent of the median.

This class-based analysis is especially useful for pinpointing the location of changes in the income distribution; such information is not provided by a uni-dimensional inequality measure like the Gini coefficient.

The estimated inequality measures for the total family income distribution for the years 1967-1985 are presented in Table 1. The Gini coefficient follows an upward trend over the period, indicating that income inequality has increased over time. Changes in the percentages of the population falling in the five income classes reveal that the increase in income inequality is largely associated with a decline in the share of families in the middle class and increases in the shares in the upper-middle and upper classes. No secular change seems to have occurred at the lower end of the distribution.

The same inequality measures were computed for the earnings distribution; the results are reported in Table 2. It is clear from these statistics that there has been no upward trend in earnings inequality. The class percentages reveal only small changes in the distribution over time: the upper class percentage seems to have increased, while the lower class percentage has decreased. [3]

One other feature of the statistics in Tables 1 and 2 deserves mention. There is a remarkably low correlation (0.29) between the Gini coefficients for the distributions of total family income and individual earnings. This

suggests that there were important changes over time in the variables that differentiate those distributions.

It is tempting to jump from the observation that there has been no trend in earnings inequality to the conclusion that technological change since the late 1960s has had no effect on the dispersion of income in the U.S. There are several reasons why we hesitate to do so. First, this conclusion would rest largely on the presumption that technological change affects the income distribution via its effect on the distribution of job/wage opportunities. As described below, the simple theoretical framework we use to consider the impact of technological change on income inequality identifies factors that would be expected to change family income inequality without affecting earnings inequality. Second, as we shall see below, focusing on the distribution of earnings among all workers masks significant differences in the trends in earnings inequality for particular subgroups of workers, e.g., males and females and workers in different industries. Finally, as noted earlier, simple time-series patterns can be quite misleading when data are potentially generated by complex multi-factor models.

III. The Economic Framework

At a theoretical level, technological change can affect the distributions of income and earnings both through changes in the structure of labor demand as well as through supply-side variables relating to labor force participation, hours of work, and family size and structure.

Consider an economy in which identical firms produce a single good

using capital and two kinds of labor: skilled labor and unskilled labor. For the time being, we will assume that the supply curves for each type of labor are perfectly inelastic. In such an economy, technological change can have three basic effects on the demand for each type of labor. These effects are (1) a pure technology effect associated with the fact that a given amount of inputs can be used to produce the same or more output; (2) a scale effect due to the downward shift of cost curves leading to an increase in product demand and, concomitantly, in labor demand; and (3) a technical bias effect arising from the fact that new ratios of factor inputs may be optimal at the old ratio of factor prices.

Whether technological change leads to a change in earnings inequality depends on whether there are differences in these 3 effects for skilled and unskilled labor. Since all firms have the same production functions in this model (and therefore the same cost curves), the first 2 effects are, by definition, the same for both types of labor. However, unless technological change is neutral, signifying that the technical bias effect is zero, labor demand will shift differently for the 2 types of labor. This should alter the ratio of skilled to unskilled wages, which will cause earnings inequality to change. For example, if technological change leads to the substitution of skilled for unskilled labor, earnings inequality will increase.

If we relax the assumption that the supplies of skilled and unskilled labor are perfectly inelastic, the change in relative wages (and therefore the change in earnings inequality) will also depend on the relative slopes of the supply curves. In the context of the preceding example, if we allow the supply of unskilled labor to be responsive to the unskilled wage, the

technical bias effect on earnings inequality will be muted. Of course, the pure technology effect and the scale effect can also affect earnings inequality when the supplies of the 2 types of labor are not perfectly inelastic. Assuming that the supply of unskilled labor is more elastic than the supply of skilled labor, the negative technology effect on labor demand will tend to decrease earnings inequality (i.e., because wages of skilled workers will fall more than the wages of unskilled workers) while the positive scale effect will tend to increase earnings inequality. Insofar as the employment shares of skilled and unskilled labor also change when labor supplies are elastic, these effects can also change sign (see Robinson, 1976). The bottom line of this part of our analysis is that the overall labor demand effect of technological change on earnings inequality is theoretically indeterminate. It is indeed remarkable that economic theory has so little to offer here, despite the strong simplifying assumptions we have made.

Changes in labor demand can affect the distribution of family income independently of their effects on earnings inequality. Suppose that all families have at most one earner, and that technological change leads to an overall decrease in labor demand, and in employment. Even if earnings inequality remains unchanged, income inequality will tend to increase. This difference arises because workers who become technologically unemployed drop out of the population of earners, but remain in the population of families. On the other hand, if families can have more than one earner, income inequality can increase or decrease depending on the income position of the families whose members become unemployed. Thus, the labor demand effects of technological change on family income inequality are also indeterminate.

So far this discussion has focused on the long-run effects of technological change. In the short run, the effect of technological change will also depend on the ability of workers to adapt to changes in the structure of labor demand. For example, workers whose human capital loses value as a consequence of technological change can respond by investing in new human capital, by investing in job search, or by taking a lower-wage job. Their choice among these alternatives will have different implications for the dynamic pattern of earnings and income inequality.

Technological change can also affect income and earnings inequality via the supply side of labor markets, i.e., through its effect on labor/leisure, market-work/home-work choices made within the family. This effect arises from the impact that technological change has on the nature of commodities consumed by the household, and on the nature of production within the household. [4] The major source of such changes in recent years involves the expanding supply of commodities that reduce the time required to maintain a household of a given quality (e.g., child care; new products in food preparation, house cleaning, and home entertainment). Also important are innovations that allow greater choice as to the type of family to which an individual belongs (e.g., new methods of contraception).

Significant changes in the family have taken place in recent years. Here, we focus on the changes related to the increasing proportion of families headed by an unmarried individual, and to the increasing labor market activity of married women. According to the March 1968 Current Population Survey, 8.0 percent of all family units were two-or-more-person families headed by an unmarried female, and 12.4 percent were females living alone. By March 1986, 12.8 percent of all families were in the former

category, and 16.2 percent in the latter. The labor force participation rate for married women increased from 45.7 percent in 1968 to 57.9 percent in 1986. The overall labor force participation rate for women also increased because of the shift to female-headed families, since female heads tend to have higher labor force participation rates than married women. The percentage of married women working full-time, year-round also increased, from 20.3 percent of all married women in 1968 to 28.9 percent in 1986. [5] This led to an increase in the percentage of married-couple families where both spouses worked full-time, year-round (15.9 percent in 1968; 21.6 percent in 1986).

It is not clear whether technological progress related to household production has been mainly a cause or consequence of changes in the structure of the family and its economic activities. Nonetheless, to the extent that technological progress has facilitated these changes, it has played an important role in increasing the labor supply of women and changing the demographic composition of households. Insofar as changes in family income inequality reflect changes in the family and changes in income, it can be argued that technological progress has a supply-side relationship to income inequality. In addition, depending on how technological change affects the supplies of skilled and unskilled labor, it can also affect earnings inequality -- in a variety of possible ways.

The main message of this section is that economic theory offers no unambiguous predictions regarding either the size or even the net direction of the effect of technological change on family income and earnings inequality. The issues at hand are completely empirical in nature.

IV. Previous Empirical Findings

The principal source of information on the distribution of total family income in the U.S. is the published data contained in the Current Population Reports P-60 series. These reports are compiled by the Bureau of Labor Statistics from the same March Current Population Survey data used in this paper. The published statistics relating to family income inequality reflect the same finding as mentioned earlier: inequality seems to have increased in recent years. The BLS measures are also available for years prior to 1967, and show essentially no trend in inequality during most of the post-World War II period up to 1967. However, the definition of the family used by the BLS differs from the one used in this paper since the BLS distributions refer to income inequality among Census families only (i.e., our definition includes unrelated individuals as separate income units as well). The omission of individuals not living in Census families dismisses a large and growing segment of the U.S. population, and eliminates one route through which technological change can affect income inequality. Nonetheless, the basic finding that there has been an upward trend in income inequality since the late 1960s is robust with respect to the definition of the family.

The claim that family income inequality has increased over the years 1968 to 1985 is not in dispute in the literature in this area. In contrast, the trend in earnings inequality is a source of much debate among academic researchers. In this section, we review research findings related to recent trends in earnings inequality in the U.S. Our major goal is to reconcile the seemingly conflicting conclusions reached by different investigators.

In reviewing this literature, it should be kept in mind that three

operational concepts underlie an "income distribution":

1) the population - does it refer to all earners, males only, wage and salary workers only, etc.?

2) the income measure - is it all earnings (including self-employment income), or just wages and salaries? and,

3) the unit of time - is it annual earnings, weekly earnings, or hourly earnings?

Careful attention should be paid to the conventions adopted by each researcher, since different conventions seem to explain much of the cross-study variance in conclusions. [6]

Differences in findings across studies can also result from the use of different techniques to measure inequality, e.g. the variance of the logarithm of earnings or the Gini coefficient. Differences in the method used for measuring inequality is another potential explanation for differences in findings among studies.

We first focus on analyses performed for the distribution of annual earnings. In a widely-quoted article, Henle and Rsycavage (1980) use grouped March CPS data to calculate Gini coefficients for all earnings (and for wages and salaries), separately for men and women, over the period 1958-1977. They also compute Gini coefficients when the sample is restricted to full-time, year-round workers only. [7,8] For men, they find an overall upward trend in inequality for all earners (with some slowing for the 1970-1977 period), but no trend for full-time, year-round workers. For women, they find no trend for all workers, and a downward trend for full-time, year-round workers. Results for a sample with both sexes combined are not

provided. The fact that Henle and Rsycavage use grouped data means that the Gini coefficients are computed from information on the percentage of total income received by various income quintiles. [9] Plotnick (1982) used the same grouped data to compute variances of the logarithm of income for all earnings, but for men only. He finds an upward trend in the variance of logarithms for the years 1968-1977, the same result reported by Henle and Rsycavage using Gini coefficients.

Dooley and Gottschalk (1984) use March CPS data on individual male workers to calculate the variance of logarithms for wage and salary income. They do this for both annual and weekly earnings over the 1967-1978 period. [10] They use a sample that is restricted so that it is representative of civilian males between the ages of 16 and 62 who were either year-round (but not necessarily full-time) workers in the previous year or were looking for work in those weeks they were not employed. They find a steep upward trend in the inequality of annual earnings over the period, with a less-pronounced increase for the inequality of weekly earnings. In their 1985 paper, they calculate the percentage of workers in their sample who fall below an arbitrarily-chosen minimum earnings level, held constant in real terms over the period. This measure is more closely akin to the concept of absolute poverty than to the concept of inequality; however, the relatively flat profile of average earnings over much of this time period implies that this research can shed some light on earnings dispersion as well. The basic finding is that both the percentage of males with low annual earnings and the percentage with low weekly earnings increased over the years 1967-1978.

One problem plaguing both Dooley-Gottschalk papers is that their samples exclude all individuals who did not respond to the earnings

questions in the CPS. The Census Bureau uses an imputation procedure for these nonrespondents that involves allocating to them the earnings level of an individual with similar characteristics who did respond to the earnings question. [11] The omission of such individuals would be no cause for concern if nonresponse was random; however, it is known that individuals with high actual earnings are more likely to be nonrespondents. Not using the imputed earnings values for these individuals results in an over-weighting of individuals with low incomes. [12] For the estimation of a regression model using CPS microdata, omitting imputed incomes may be an appropriate strategy (see Welch, 1979); for estimating a population average, such as a variance of logarithms, it is not.

A recent paper by Harrison, Tilly and Bluestone (1986) uses March CPS data to look at the inequality of annual wage and salary income, for all earners, over the years 1964-1983. Using individual-level data to calculate the variance of logarithms, they find evidence of a "U-turn" in inequality -- the variance of logarithms fell gradually until the late 1970s, after which it began to rise sharply. The same pattern emerges when "all earnings" is the income measure. When the sample is separated by sex, they find decreasing dispersion for all women over the 1967-1977 period, followed by a sharp increase. This result for 1967-1977 conflicts with the findings of Henle-Rsycavage, who find decreasing inequality for females only when the sample is restricted to females who worked full-time, year-round. Harrison, et. al., also find virtually no increase in inequality for men over the 1969-1977 period, contradicting the Henle and Rsycavage finding that it increased. The difference in findings between these studies is not easily explained. However, it does not appear to be due to the measure of

inequality used, given Plotnick's finding that the variance of logarithms increased (consistent with Henle and Rsycavage); neither does it appear to reflect differences in the earnings variables since Henle and Rsycavage reach the same conclusion using both "all earnings" and "wage and salary income." [13] Harrison, et. al., argue that the shift in employment from the goods-producing sector to the service-producing sector is the primary reason for their finding of an increase in inequality in earnings inequality since the late 1970s. [14] However, they do not present any evidence on the inequality of annual earnings within industrial sectors.

Evidence related to inequality within industries, using weekly earnings as the income measure, is reported in Lawrence (1984). This study concludes that the employment shift from goods to services explains only a small part of the decline from 1969 to 1983 in the proportion of earners who are "middle-income." Lawrence uses a measure of "usual weekly earnings" from the CPS that includes only wage and salary income. The sample is restricted to full-time workers who were employed at the time of the survey. The income variable -- usual weekly earnings -- is conceptually distinct from another possible weekly earnings measure -- average weekly earnings -- which is calculated as the ratio of annual earnings to weeks worked over the course of the year. Since usual weekly earnings is available in the CPS only for individuals who are employed at the time of the survey, the sample Lawrence uses will have a higher percentage of year-round workers than the samples used in the analyses of annual earnings inequality.

In Lawrence's study, workers are classified as either low earners (defined as less than 66 percent of the median level of earnings among males), high earners (more than 132 percent of the median for males), or

middle earners. He finds that the percentage of males with "middle earnings" fell from 56 percent in 1969 to 47 percent in 1983; for females, it increased from 39 percent to 44 percent; while for both sexes combined it went from 50 percent to 46 percent. [15] Lawrence also subdivides the sample according to whether the worker is employed in a goods-producing or a service-producing industry, and finds that little of the change in the percentage of middle earners can be attributed to the increase in the proportion of service workers from 1969 to 1983. Rather, the middle-class decline occurred within the service sector and, especially, within the goods sector. No data for intervening years are analyzed by Lawrence.

Rosenthal (1985) examines the same hypothesis as Lawrence -- that the middle of the earnings distribution has declined -- but, unlike Lawrence, comes to the conclusion that no decline occurred. While Rosenthal uses the same income measure as Lawrence -- usual weekly earnings for full-time workers -- his analysis varies from that of Lawrence in several ways. Rosenthal separates 416 three-digit occupations into thirds based on the median income among workers in the occupation in 1982 (i.e., the "top third" contains the 33 percent highest-paying occupations). He then calculates the percentage of employees in the occupations that make up each of the thirds of the occupational ranking, for both 1973 and 1982. He finds that the fraction of workers in the "middle third" did not change over the period, while there was a decline in employment in the lower third and an increase in the top third. Thus, the highest-paying occupations also have the highest rate of employment growth. Including part-time workers does not change the basic conclusion.

Rosenthal's analysis provides incomplete information on the extent to

which the overall change in inequality is due to a changing occupational structure because it ignores all variation of incomes within occupations. It also ignores any changes in the variation of incomes across occupations that fall within the bottom third, middle third, and top third of the occupational ranking. Contrary to the claims made in his conclusion, his study does not address the question of whether the earnings distribution has seen a decline in its "middle." However, Rosenthal's study nicely complements the Lawrence study, in that together they cast doubt on the hypotheses about broad industry and broad occupational shifts being responsible for any increase in weekly earnings inequality that may have occurred. [16]

The only recent analysis of hourly wages has been conducted by Medoff (1984). This study has sample restrictions that are similar to those of Lawrence, and uses data on "usual weekly earnings" and "usual weekly hours worked" to compute an hourly earnings measure for employed individuals in the May CPS for various years. [17] Medoff finds that the variance of the logarithm of hourly earnings was at about the same level in 1984 as it was in 1973 and 1975. However, his results do show that earnings inequality increased from 1981 to 1984 (which he attributes to changes in the macroeconomic environment). He separates the samples for males and females and finds little evidence of a trend in hourly earnings inequality for either. He does, however, find evidence of increasing inequality within the manufacturing sector for the 1980s relative to 1973-1975, but a slight (though uneven) decrease in inequality for the nonmanufacturing sector. [18]

What is the bottom line on trends in earnings inequality? As should be clear from the foregoing discussion, different studies have reached widely

varying conclusions. Unfortunately, since these studies typically use methods that also vary widely, it is difficult to infer much about the trend in earnings inequality. For example, Medoff finds no increase in inequality in wages and salaries from 1973 to 1983, while Harrison, et. al., do find an increase. This conflict could be due to differences in the underlying populations analyzed (Medoff excludes public and agricultural workers, and any individual not employed at the time of the survey), different income measures ("usual" earnings versus earnings in the previous year) and different time periods (hourly versus annual). The only directly comparable results among the studies reviewed are from Plotnick and Harrison, et. al., for male annual earnings inequality in the late 1960's-early 1970's period; yet even here Plotnick finds an increasing trend, while Harrison, et. al., do not. [19]

The weight of the evidence does, nonetheless, seem to suggest an increase in male earnings inequality and a decrease in female earnings inequality over the years 1967-1975. It also appears that male earnings inequality increased from 1975 to 1983, while the results for females and all earners do not strongly support any conclusion.

V. Trends and Patterns in Earnings Inequality

In this section, we analyze earnings inequality over the years 1968 to 1985. We extend the empirical analysis presented in Section II in several ways. First we consider inequality for males and females separately. Second, we attempt to control for variations in hours worked by restricting the population to full-time, year-round workers. Finally, we examine inequality within six industrial sectors to see if there are any cross-

industry differences.

Before presenting the results, we discuss the source of our data. We also discuss our approach to measuring inequality.

A. Data

The data we analyze are drawn from the March Current Population Survey public use samples for the nineteen years from 1968 to 1986. These data are commonly used in studies of income inequality in the U.S. We use 10 percent samples of the original data. For our purposes, a major strength of the CPS data is that they are representative of the U.S. population. Observations with imputed incomes are included in our analysis, and sample weights are used in our computations. [20]

The March CPS data are not without their shortcomings. One undesirable characteristic of these data is a tendency for certain sources of income to be underreported by survey respondents. This is not a problem for the earnings measures, since earnings, especially wage and salary income, tends to be well-reported. However, both cash transfers and interest/dividend income are not well-reported, and these sources show up in the family income measures used later. We assume that such underreporting is fairly stable over time and therefore does not bias inferences concerning the trend in inequality, although it does limit our ability to measure inequality accurately at a point in time. The fact that the share of income received as transfers has not grown since 1973 supports this assumption.

Another problem that arises for the family income distribution but not for the earnings distribution is the fact that the family is defined at the time of the survey, which is in March, although the reported income

corresponds to the previous calendar year. If changes in the composition of a family occur between the time income is reported and the time the survey is taken, then the measure of total family income may not reflect the actual income received by the family. Burkhauser, et. al. (1986) have looked at the effect of this problem on measures of the transition into poverty among newly-widowed women, and have found that the bias for estimated transition probabilities can be large. However, they found the bias for the overall poverty rate to be small, suggesting that the problem may be relatively minor when calculating aggregate inequality measures.

There is also a "top-coding" problem with the earnings data that does not seem to have been fully appreciated in earlier research using the CPS. There are three sources of information on earnings in the March CPS data: wage and salary income, farm self-employment income, and non-farm self-employment income. Prior to the 1981 survey, these three sources of earned income were never recorded as being above $50,000 -- in nominal dollars. All incomes greater than that amount were coded as equal to $50,000. Given the substantial inflation over the 1967-1980 period, the effect of holding the top-coded income level constant was to reduce the upper bound for the earnings measure -- in real terms -- over time. Narrowing the bounds within which income can be reported will bias most inequality measures downward. We deal with this problem by recoding earnings so that no figure above 50,000 dollars in 1980 terms will be used, i.e., we use a consistent real-dollar top-code over the 1967-1985 period. [21] Our analysis of changes in inequality does not, therefore, account for changes in the shape of the upper tail of the income distribution.

B. Measuring Inequality

The purpose of an income inequality index is to summarize the degree of income dispersion among N income-receiving units. There are many measures of inequality, each of which implicitly weights the sample data differently (see Atkinson, 1970; Champernowne, 1974). Since different inequality measures can sometimes lead to different results, we base our analysis on three single-number inequality indices: the Gini coefficient; the mean logarithmic deviation; and the coeffecient of variation. [22] All three measures satisfy the main properties that are generally considered desirable for an inequality index. However, each index is particularly sensitive to changes in different parts of the income distribution: the mean logarithmic deviation to changes at lower levels of income; the coefficient of variation to changes at higher levels of income; and the Gini coefficient to changes around the middle of the income distribution.

We also continue to use the more descriptive class measures outlined in Section II. A weakness of this measurement scheme is its insensitivity to changes that might occur within classes of the distribution. However, in practice, this group of measures does seem to highlight much of the change in the shape of the distribution. These measures also have an attractive characteristic that the three indices mentioned above do not: the class measures are not biased by the top-coding of incomes in the CPS. This is because the cutoff point for the upper class, i.e., 225 percent of the median income, always lies below the level at which earned income was top-coded. The upper-class cutoff for the family income distributions discussed in Section VI also lies beneath the top-code.

C. Results for Earnings

The Gini coefficient and the class percentages for the distribution of earnings among all individuals are reported in Table 2. Table 3 extends the results by presenting the mean logarithmic deviation and the coefficient of variation for the same distribution for the years 1967-1985. Table 3 also reports the three inequality measures for the earnings distribution when the population is restricted to full-time, year-round workers. Our earlier conclusion that earnings inequality has not changed significantly since the late 1960s is further supported by examination of these additional measures.

Each time series of a particular inequality index in Table 3 was regressed on a simple trend variable to provide a descriptive measure of the time trend in inequality. Regressions of each inequality index on a trend and the adult male unemployment rate were also fit in an attempt to describe the trend in inequality controlling, at least crudely, for business cycle effects on inequality. [23]

The estimated trend coefficients in the earnings inequality regressions are presented at the bottom of Table 3. The conclusion that earnings inequality has not increased over time is supported by the estimates. The trend coefficient for all workers is small and insignificant when the dependent variable is the coefficient of variation, while it is significant and negative for the mean logarithmic deviation. We noted earlier in the discussion of Table 2 that the lower class percentage for the earnings distribution fell over the period, while there was a slight increase in the upper-class percentage. The difference in trend coefficients for the coefficient of variation and the mean logarithmic deviation reflects the relatively greater sensitivity of the mean logarithmic deviation to changes

at the lower end of the distribution. [24]

Table 4 reports earnings inequality measures calculated separately for males and females. The statistics in this table reveal that there were widely different trends in earnings inequality for males and females who worked in the years 1967-1985. [25] Earnings inequality did not change for females who worked full-time, year-round, and actually fell for all women. In contrast, earnings inequality for males increases, both for the population of all workers, and for full-time, year-round workers only. Blackburn (1987) presents evidence that the increase in earnings inequality for males is the result of changes in the age composition of the male labor force and, to a lesser extent, industrial shifts. [26]

Restricting the population to full-time, year-round workers is an attempt to control for changes over time in hours worked. A slightly different way to control for hours worked is to examine the distribution of hourly wage rates. [27] We are able to compute wage rates using the March CPS data by dividing the annual earnings measure for each individual by the product of weeks worked and hours worked per week for that same individual. Unfortunately, the information on hours worked is only available beginning with the 1976 survey. Table 5 reports the mean logarithmic deviation and the coefficient of variation for hourly wages, reported separately for males and females, over the 1975-1985 period. There is much variance in the indices over time (especially for the coefficient of variation), making it difficult to pinpoint any trend. It would seem that there is no clear trend for either males or females, except perhaps an increasing trend for male wage inequality when the mean logarithmic deviation is the index used.

D. Earnings by Industry

This section analyzes trends in earnings inequality within and across industries. As mentioned earlier, there has been a shift over time from goods-oriented to service-oriented employment. For instance, 41 percent of full-time, year-round workers were employed in goods-producing industries in 1967, with the remaining 59 percent employed in the service-producing industries. By 1984, the goods-producing share of employment had fallen to 31 percent, while the service-producing share had risen to 69 percent. Since inequality is higher within service-producing industries, this shift would, other things equal, tend to increase overall earnings inequality.

Table 6 reports Gini coefficients for earnings within six broad industrial groupings. [28] Only full-time, year-round workers are included in the samples analyzed here. It is apparent that there are substantial differences in the level of earnings inequality within these industry groups, with manufacturing, public administration, and the "traditional" services groups having the lowest Gini coefficients, and the services, trade, and other goods sectors having the highest levels of inequality. [29] The share of full-time, year-round workers in the three industries with higher inequality increased from 49.7 percent in 1967 to 54.9 percent in 1984. This employment shift contributed to increased earnings inequality, although the magnitude of the effect is small. We can calculate this magnitude using a decomposition of the mean logarithmic deviation that allows us to express changes in inequality as a simple function of changes in industry employment shares, changes in industry mean incomes, and changes in inequality within industries (see Bourguignon, 1979). Using this property, we calculate that the industry employment shifts can account for

an increase in the mean logarithmic deviation of .005, or about 40 percent of the (small) total increase from .207 in 1967 to .219 in 1984. [30] These results provide little support for the Harrison, Tilly, and Bluestone argument that sectoral shift has led to increased earnings inequality.

Earnings inequality did not move in the same direction for each industrial sector between 1967 and 1985. For instance, inequality increased in manufacturing, traditional services, and public adminstration, fell slightly in services and other goods, and held steady in trade. As a result, there was less variation in the level of inequality across industries in 1985 than in 1967.

VI. The Family Income Distribution

This section presents a more detailed examination of trends in the distribution of income when the family is the unit of analysis. As discussed in Section III, technological change can influence supply-side behavior in a way that affects income inequality measured across families without affecting earnings inequality measured across individuals. Indeed, the empirical facts reported in Section II are consistent with the hypothesis that the effects of technological change on the distribution of well-being operate primarily through the supply side, and not the demand side, of labor markets.

As we alluded to earlier, there are conceptual problems with the income data available from the Current Population Survey. Ideally, one would like to have a measure of income that closely reflects the level of economic well-being of the family unit. The CPS income measure falls short of this ideal in several ways. First, it does not include non-cash transfers, nor

does it include capital gains income. Second, there is no natural control for the fact that families with different compositions will derive different amounts of well-being from the same level of income. Third, CPS income data refer to pre-tax income. With regard to this last point, Pechman (1987) shows that there has been little change in the progressivity of the tax system from 1966 to 1985. [31] This finding makes the use of pre-tax income in studying the dispersion of incomes somewhat less objectionable. [32]

In Section II, it was shown that there was an increase in total family income inequality over the years 1967 to 1985. To investigate the sources of this trend, we now consider three related distributions. First, we examine the distribution of equivalent income, which lets us control, though imperfectly, for the effects of family composition. Second, we examine the distribution of total family earnings, which allows us to assess the importance of changes in the distribution of income that families receive from the labor market. This distribution is compared to the distribution of earnings among families' principal earners. This latter distribution allows us to examine inequality among families when the number of earners per family is held constant.

A. Equivalent Income

The income measure for the distribution of equivalent income is constructed by dividing the level of income for each family by the number of equivalent adults in the family, determined through a set of equivalence scales. Each person is assigned the equivalent income of his or her family, with inequality measured across persons. As pointed out by Danziger and Taussig (1979), this distribution relates more closely to well-being

than the distribution of family income since it explicitly recognizes certain key differences among families (e.g., that large families need more income to achieve a given level of welfare than small families). The equivalence scales used are those implicit in the BLS poverty lines developed by Orshansky (1965).

The results for the distribution of equivalent income are reported in Table 7. The Gini coefficient increases for this distribution, as it did for the distribution of total family income. However, unlike the increase in total family income inequality, most of the increase for equivalent income occurred in the last five years studied. Looking at the class percentages, the major change appears to be a movement from the lower-middle class to the lower class.

B. Total Family Earnings

The distribution of total family earnings uses the sum of the earnings of each member of a family as the measure of income for that family. Some families have zero total earnings over the year in question; these families are dropped from our sample. This makes the sample comparable to the sample used for the distribution of earnings among principal earners that we discuss below. The total family earnings distribution suffers from the inconsistent top-code problem mentioned in Section V. We deal with this problem by using income-class shares to study changes in the shape of the distribution and to compare its shape with other distributions.

Table 8 contains class breakdowns for the family earnings distribution. The inequality of family earnings appears to have increased over the years 1967 to 1985. Changes in the upper end of the distribution are similar to those that occurred for the distribution of total family income. There was

also a shift from the lower-middle to the lower class, which does not occur for the total family income distribution.

C. The Principal Earner

For each family, we define the principal earner to be (roughly) the family member with the highest level of earnings in the previous year. [33] We use this construct as an alternative to the "head of the household," since the Census Bureau's definition of the household head changed over the 1967-1985 period. [34] Reported earnings were consistently top-coded at $50,000, in 1980 dollars, in the same manner as described in Section V for the earnings of all individuals.

The class breakdown and the Gini coefficient for the distribution of earnings among principal earners are reported in Table 9. As with the distribution of total family earnings, we observe a rise in the lower class and upper class shares that coincides with a fall in the middle class share. Table 10 reports the Gini coefficient and the mean logarithmic deviation for principal earners separately by sex, and by full-time, year-round status. The trends are similar to those observed for the distributions of individual earnings, with inequality rising for males and falling for females. The fact that males constitute a larger fraction of the principal earner population than of the all-earners populations explains why earnings inequality for principal earners increases, whereas no increase is observed for the earnings distribution measured across all earners.

A change in the percentage of principal earners who work full-time, year-round might also be expected to affect earnings inequality among principal earners. Suprisingly, there was little change in this statistic

from 1967 to 1985. Table 11 reports the percentage of principal earners who worked full-time, year-round for four types of families in both 1967 and 1985. The statistics reveal a shift from married-couple families to non-traditional families and a decline in the proportion of full-time year-round workers among female-headed single parent families. These changes would have led to a decline in the full-time year-round percentage for all principal earners, since married couples have the highest probability of having a full-time, year-round principal earner. However, their effect seems to have been offset by increases in the percentages of female unrelated individuals and male-headed single-parent families and unrelated individuals who work full-time, year-round. [35]

In Blackburn and Bloom (1987), we presented results suggesting that the growth in married females' earnings has not contributed to increasing inequality of total family income over the years 1967-1984. However, comparing the class percentages for total family earnings and earnings among principal earners suggests that the earnings of non-principal earners has had a positive impact on inequality. Both distributions have become more disperse over time, but the change is larger for the distribution of total family earnings. To describe these changes more precisely, we fit regressions of the lower-class, middle-class, and upper-class percentages for the two distributions on a time trend, and on a time trend and the adult male unemployment rate. The results are reported in Table 12. The trend coefficients are uniformly smaller (in absolute value) for the principal earner distribution, and are much smaller when looking at the upper class percentages. This indicates that a significantly larger percentage of families were moved into the upper class when using all earnings -- which

includes the earnings of non-principal earners -- than when only the earnings of principal earners are included. This implies that changing family behavior related to the labor force participation of its members has had a positive impact on the inequality of total family income.

VII. Conclusion

This paper has explored the relationship between technological change and inequality in the U.S. since the late 1960's. Because technological change is so difficult to characterize and measure at an aggregate level, our analysis has focused primarily on studying patterns and trends in the dispersion of various distributions of earnings and income during this recent period of rapid technological progress. If technological change is related to inequality, we would expect the inequality data for this period to reveal systematic patterns. Although economic theory has little to offer regarding the nature of such patterns, it does provide some useful suggestions about the type of income and earnings distributions one might study and compare to explore the linkage between technological change and inequality. Thus, under the assumption that the impact of technological on inequality operates primarily through the demand side of labor markets -- by altering the nature of jobs and therefore of wage opportunities -- we would expect to see shifts in the inequality of earnings measured across individuals. In contrast, if the impact of technological change has affected inequality primarily as a supply-side phenomenon -- through changes in decisions about family size, structure, and labor supply -- we would expect to see limited changes in earnings inequality measured across

individuals, but sizable changes in the distribution of total family income measured across families.

On the basis of our review of relevant literature, and several empirical analyses we performed using microdata from the March Current Population Surveys from 1968 to 1986, we have four main sets of results to report.

1. The often-contradictory conclusions reached by studies of recent trends in income and earnings inequality are largely explained by the reliance of different researchers on a remarkably wide range of data analytic conventions. For example, the list of important dimensions in which previous studies vary includes (1) the time period covered; (2) the way family units are defined; (3) the population to which the studies of individual earnings generalize (e.g., all earners, private non-agricultural workers, male earners, wage and salary workers, full-time year-round workers, etc.); (4) the measures of earnings and income (e.g., total family income, equivalent family income, total family earnings, wage and salary income, etc.); (5) the unit of time for the measurement of earnings (e.g., annual, weekly, or hourly); (6) the nature of the earnings measure (e.g., usual earnings, or average earnings); (7) measures of inequality (e.g., the Gini coefficient, income-class shares, variance of logarithms, coefficient of variation, mean logarithmic deviation, etc.); (8) the use of individual or grouped income/earnings data; (9) the treatment of sample weights; (10) the treatment of observations with imputed incomes; (11) the handling of top-coded values of income and earnings; and (12) other criteria for including observations in the sample such as the age of the respondent and whether the respondent was working at the time of the survey or in the year

preceding the survey.

2. The time profile of earnings inequality, measured across individual workers has been quite flat since the late 1960's. Among females, earnings inequality fell over time, although it was flat for women who worked full-time, year-round. In contrast, earnings inequality increased for males, both among the population of all workers and that of full-time, year-round workers. The upward trend in earnings inequality for males is less apparent if one focuses on the dispersion in hourly earnings, suggesting that some of the increase in the dispersion of annual earnings is due to increased dispersion in the supply of labor by males. In related work, Blackburn (1987) presents evidence that the increase in earnings inequality for males is closely related to changes in the age composition of the male labor force and somewhat related to changes in employment shares across industries.

3. Earnings inequality among full-time, year-round workers varies substantially across industries. Although high-inequality industries increased their share of total employment from 1967 to 1984, this change can only account for a small fraction of the small increase in earnings inequality over those years. Thus, our results provide little support for either part of the compound hypothesis that earnings inequality has increased and that the increase was primarily the result of sectoral shift in the U.S. economy.

4. Inequality of total family income and total family earnings increased from 1967 to 1985. Inequality of equivalent income (i.e., total family income divided by the number of equivalent adults in the family) also tended to increase over this period, though most of the increase took place in the 1980's. Dispersion in the distribution of earnings among families'

principal earners also increased since the late 1960's, although the overall increase reflects a combination of an increase for male principal earners and a decrease for female principal earners. A comparison of the magnitude of changes in the inequality of total family earnings and of earnings among principal earners leads one to conclude further that the earnings of non-principal earners has had a positive effect on income inequality over the past two decades.

The main message of this paper is that there is little empirical evidence that earnings inequality has increased since the late 1960's, and even less evidence to support the hypothesis that any changes that have occurred have resulted from the effect of technological change on the demand for labor. However, the fact that inequality of total family income increased since the late 1960's, and that some of the increase appears to be due to changes in family composition and labor supply behavior, is consistent with the hypothesis that technological change has had positive supply-side effects on income inequality in the United States. Unfortunately, the nebulous nature of technological change, the multiplicity of ways in which technological change can affect inequality, and the fact that inequality is influenced by many other economic and demographic forces as well, makes it impossible to know whether recent trends in inequality will continue into the future.

Table 1
Inequality Measures for the Distribution
of Total Family Income [*]

Year	Gini	LC	LMC	MC	UMC	UC
1967	.395	.297	.203	.275	.143	.083
1968	.389	.296	.204	.274	.145	.080
1969	.393	.294	.206	.258	.151	.091
1970	.406	.304	.196	.261	.144	.095
1971	.405	.300	.200	.251	.142	.107
1972	.404	.297	.203	.256	.142	.102
1973	.403	.299	.201	.253	.140	.108
1974	.393	.302	.198	.262	.143	.095
1975	.400	.291	.209	.257	.139	.103
1976	.410	.306	.194	.237	.152	.112
1977	.409	.306	.194	.238	.144	.117
1978	.402	.296	.204	.229	.152	.119
1979	.412	.307	.193	.230	.155	.115
1980	.392	.297	.203	.246	.144	.110
1981	.412	.299	.201	.235	.145	.119
1982	.414	.307	.193	.232	.142	.126
1983	.425	.313	.187	.219	.148	.132
1984	.416	.298	.202	.225	.145	.130
1985	.426	.297	.203	.213	.145	.142

[*] The population includes both Census families and unrelated individuals. The class measures are defined in the text. Total family income includes earned income, interest and dividend income, and government cash transfer income.

Table 2
Inequality Measures for the Distribution of Annual Earnings Across Individuals [*]

Year	Gini	LC	LMC	MC	UMC	UC
1967	.459	.344	.156	.202	.155	.143
1968	.462	.353	.147	.203	.164	.133
1969	.466	.348	.152	.195	.163	.142
1970	.466	.345	.155	.208	.157	.135
1971	.472	.348	.152	.195	.162	.143
1972	.472	.336	.144	.197	.162	.141
1973	.474	.353	.147	.191	.149	.160
1974	.466	.347	.153	.188	.160	.152
1975	.468	.345	.155	.198	.148	.155
1976	.469	.349	.151	.208	.135	.156
1977	.468	.343	.157	.185	.152	.163
1978	.461	.336	.164	.195	.140	.165
1979	.464	.335	.165	.200	.154	.146
1980	.454	.328	.172	.212	.149	.138
1981	.460	.335	.165	.211	.144	.145
1982	.470	.345	.155	.194	.142	.164
1983	.464	.351	.149	.210	.137	.154
1984	.468	.331	.169	.189	.135	.176
1985	.467	.338	.162	.201	.131	.168

[*] The earnings measure includes both wage and salary income and self-employment income. All individuals with positive earnings in the year preceding the survey were included in the sample.

Table 3
Other Measures of Inequality for the Distribution of Annual Earnings Across Individual [*]

	All Earners		Full-time, Year-round Only		
Year	MLD	CV	Gini	MLD	CV
1967	.608	.856	.313	.207	.588
1968	.609	.857	.308	.206	.574
1969	.630	.865	.302	.186	.560
1970	.630	.865	.307	.194	.571
1971	.638	.880	.310	.191	.577
1972	.629	.878	.307	.202	.568
1973	.627	.882	.310	.200	.573
1974	.601	.870	.310	.205	.578
1975	.604	.875	.299	.170	.558
1976	.603	.879	.303	.187	.564
1977	.616	.870	.300	.180	.554
1978	.583	.859	.302	.187	.562
1979	.600	.868	.309	.193	.576
1980	.560	.851	.302	.184	.569
1981	.577	.858	.311	.201	.585
1982	.597	.891	.323	.222	.607
1983	.600	.869	.319	.232	.592
1984	.600	.881	.322	.219	.602
1985	.591	.874	.320	.213	.593
Trend Coeff.	-.0021 (.0009)	.0005 (.0005)	.0005 (.0004)	.0008 (.0010)	.0009 (.0009)
Trend Coeff. Without Cycle	-.0025 (.0013)	-.0005 (.0008)	.0006 (.0006)	.0010 (.0013)	.0010 (.0011)

[*] Full-time, year-round workers are defined as individuals who worked 35 or more hours per week for at least fifty weeks over the course of the year for which earnings is reported. MLD is the mean logarithmic deviation, and CV is the coefficient of variation.

Table 4
Earnings Inequality for Males and Females

	All Workers				Full-time, Year-round Only			
	Males		Females		Males		Females	
Year	Gini	MLD	Gini	MLD	Gini	MLD	Gini	MLD
1967	.389	.468	.477	.630	.281	.174	.283	.178
1968	.390	.460	.481	.636	.278	.171	.278	.186
1969	.398	.477	.488	.677	.272	.161	.272	.151
1970	.401	.499	.481	.649	.281	.178	.265	.139
1971	.406	.496	.485	.661	.284	.172	.265	.141
1972	.405	.483	.480	.649	.278	.181	.259	.142
1973	.403	.479	.481	.633	.278	.171	.267	.153
1974	.401	.468	.476	.617	.282	.181	.275	.164
1975	.406	.473	.478	.622	.276	.153	.255	.122
1976	.408	.481	.470	.600	.280	.171	.252	.135
1977	.405	.490	.475	.624	.274	.166	.256	.127
1978	.403	.460	.466	.603	.277	.161	.259	.157
1979	.408	.478	.456	.606	.285	.176	.253	.134
1980	.399	.436	.454	.584	.278	.153	.259	.165
1981	.411	.486	.452	.572	.293	.196	.263	.138
1982	.428	.509	.461	.593	.301	.203	.279	.177
1983	.423	.527	.460	.591	.301	.231	.282	.176
1984	.428	.519	.460	.593	.308	.206	.275	.178
1985	.424	.491	.468	.612	.305	.197	.288	.184
Trend Coeff. (/100)	.18 (.04)	.15 (.12)	-.12 (.05)	-.36 (.10)	.14 (.05)	.19 (.09)	.02 (.09)	.06 (.12)
Trend Coeff. Without Cycle (/100)	.13 (.05)	-.01 (.15)	-.14 (.06)	-.32 (.14)	.15 (.07)	.14 (.14)	.03 (.11)	.13 (.17)

Table 5
Inequality Measures for the Distribution of Wages,
for Males and Females [*]

	Males		Females	
Year	MLD	CV	MLD	CV
1975	.253	.752	.235	.865
1976	.271	.781	.215	.752
1977	.253	.728	.241	.937
1978	.251	.767	.248	.947
1979	.257	.689	.261	.870
1980	.226	.654	.273	.967
1981	.273	.748	.228	.793
1982	.280	.748	.242	.752
1983	.271	.753	.256	.777
1984	.291	.767	.280	.950
1985	.277	.753	.290	.869

[*] The wages were computed as annual earnings divided by the product of hours worked per week and weeks worked over the year. Wages above $99.99 an hour (in 1983 dollars) were top-coded at $99.99.

Table 6
Gini Coefficients For Earnings Within Industry Groups,
Full-time, Year-round Workers [*]

Year	Manuf.	Other Goods	Trad. Services	Trade	Services	Public Admn.
1967	.266	.368	.269	.345	.363	.240
1968	.263	.377	.278	.329	.355	.226
1969	.266	.324	.266	.334	.349	.246
1970	.270	.370	.276	.324	.342	.240
1971	.257	.374	.293	.336	.338	.256
1972	.273	.352	.285	.339	.324	.249
1973	.279	.333	.277	.332	.348	.258
1974	.273	.360	.285	.341	.325	.282
1975	.265	.333	.270	.327	.321	.257
1976	.261	.366	.277	.325	.325	.258
1977	.265	.339	.269	.329	.322	.245
1978	.284	.315	.273	.323	.323	.226
1979	.267	.346	.287	.340	.328	.268
1980	.275	.323	.289	.321	.318	.250
1981	.270	.362	.290	.340	.328	.245
1982	.286	.355	.297	.341	.351	.246
1983	.286	.360	.293	.345	.330	.273
1984	.287	.351	.298	.342	.336	.271
1985	.285	.330	.294	.355	.343	.260
Trend Coeff.	.0012 (.0003)	-.0010 (.0007)	.0013 (.0004)	.0005 (.0004)	-.0008 (.0009)	.0008 (.0006)
Trend Coeff. Without Cycle	.0014 (.0005)	-.0034 (.0009)	.0011 (.0007)	.0009 (.0007)	-.0011 (.0012)	.0014 (.0011)

[*] "Other goods" includes agriculture, construction and mining. "Traditional Services" includes transportation, communications, public utilities, financial services, insurance, and real estate. "Services" includes personal, business and repair, entertainment and recreation, and professional and related services.

Table 7
Inequality Measures for the Distribution of Equivalent Income Across Persons in the U.S.

Year	Gini	LC	LMC	MC	UMC	UC
1967	.367	.255	.245	.277	.129	.094
1968	.360	.237	.263	.287	.126	.087
1969	.364	.246	.254	.276	.131	.094
1970	.367	.242	.258	.273	.139	.088
1971	.371	.239	.261	.277	.128	.095
1972	.362	.245	.255	.290	.125	.084
1973	.363	.233	.267	.269	.143	.088
1974	.362	.243	.257	.284	.130	.086
1975	.364	.254	.246	.267	.144	.089
1976	.367	.255	.245	.291	.125	.084
1977	.358	.251	.249	.276	.140	.083
1978	.361	.243	.257	.273	.140	.087
1979	.363	.252	.248	.274	.141	.086
1980	.357	.257	.243	.283	.138	.079
1981	.380	.271	.229	.270	.139	.091
1982	.390	.270	.230	.253	.145	.102
1983	.395	.280	.220	.259	.135	.106
1984	.391	.280	.220	.272	.128	.100
1985	.394	.273	.227	.260	.137	.103

Table 8
Inequality Measures for the Distribution
of Total Family Earnings [*]

Year	LC	LMC	MC	UMC	UC
1967	.263	.237	.293	.141	.066
1968	.256	.244	.308	.129	.063
1969	.265	.235	.289	.137	.074
1970	.275	.225	.297	.129	.074
1971	.283	.217	.286	.133	.080
1972	.270	.230	.282	.135	.083
1973	.268	.232	.273	.139	.088
1974	.281	.219	.286	.136	.078
1975	.272	.228	.277	.137	.086
1976	.281	.219	.271	.138	.091
1977	.288	.212	.268	.148	.084
1978	.285	.215	.266	.144	.090
1979	.297	.203	.269	.141	.090
1980	.279	.221	.265	.148	.087
1981	.278	.222	.271	.138	.091
1982	.292	.208	.252	.140	.108
1983	.294	.206	.248	.148	.103
1984	.287	.213	.249	.151	.100
1985	.286	.214	.229	.155	.116

[*] The relevant population includes only those families with positive earnings for the year in question.

Table 9
Inequality Measures for the Distribution of Earnings
Among Principal Earners [*]

Year	Gini	LC	LMC	MC	UMC	UC
1967	.346	.252	.248	.314	.130	.056
1968	.342	.236	.264	.331	.104	.065
1969	.351	.261	.239	.315	.123	.061
1970	.357	.260	.240	.316	.115	.069
1971	.360	.268	.232	.320	.112	.068
1972	.359	.248	.252	.305	.117	.078
1973	.354	.264	.236	.295	.133	.073
1974	.360	.271	.229	.325	.114	.061
1975	.357	.250	.250	.289	.137	.074
1976	.367	.270	.230	.279	.140	.082
1977	.357	.276	.224	.302	.133	.065
1978	.362	.261	.239	.278	.146	.076
1979	.367	.276	.224	.280	.141	.079
1980	.357	.254	.246	.294	.138	.067
1981	.360	.252	.248	.294	.128	.077
1982	.375	.283	.217	.291	.126	.082
1983	.373	.285	.215	.281	.146	.073
1984	.372	.271	.229	.294	.124	.082
1985	.374	.277	.223	.273	.140	.086

[*] The principal earner is defined as the head of household for non-married couple families. For married couples, the principal earner is the spouse with the higher level of earnings in the year preceding the survey.

Table 10
Earnings Inequality Among Principal Earners,
Males and Females

Year	All Workers				Full-time, Year-round Only			
	Males		Females		Males		Females	
	Gini	MLD	Gini	MLD	Gini	MLD	Gini	MLD
1967	.303	.227	.416	.452	.264	.146	.295	.195
1968	.302	.217	.417	.439	.263	.140	.307	.218
1969	.309	.244	.417	.407	.260	.143	.297	.178
1970	.316	.254	.408	.441	.267	.150	.291	.159
1971	.319	.246	.420	.460	.268	.135	.272	.139
1972	.317	.258	.409	.487	.264	.153	.270	.161
1973	.312	.251	.402	.435	.262	.148	.261	.130
1974	.317	.260	.395	.447	.264	.148	.253	.139
1975	.320	.242	.393	.413	.262	.131	.249	.117
1976	.326	.264	.393	.411	.265	.145	.250	.134
1977	.312	.236	.385	.418	.255	.145	.257	.131
1978	.321	.254	.396	.418	.263	.134	.256	.127
1979	.323	.264	.385	.415	.265	.149	.255	.122
1980	.318	.241	.382	.405	.260	.129	.260	.138
1981	.322	.256	.381	.380	.272	.155	.266	.140
1982	.338	.281	.393	.379	.280	.163	.280	.144
1983	.335	.294	.397	.392	.277	.173	.287	.163
1984	.340	.289	.386	.414	.282	.160	.272	.161
1985	.334	.260	.402	.410	.277	.153	.277	.137
Trend Coeff. (/100)	.17 (.03)	.24 (.07)	-.15 (.05)	-.39 (.09)	.08 (.04)	.08 (.06)	-.10 (.12)	-.26 (.16)
Trend Coeff. Without Cycle (/100)	.10 (.04)	.13 (.10)	-.17 (.07)	-.22 (.14)	.06 (.05)	.06 (.09)	-.14 (.13)	-.23 (.19)

Table 11
Percentage of Principal Earners Working Full-time, Year-round, By Family Type, in 1967 and 1985 [*]

Family Type	Percent Full-time, Year-round		Percent of Principal Earner Pop.	
	1967	1985	1967	1985
Married-Couple	78.4	79.1	77.3	65.3
Male-Headed Single-Parent Family or Unrelated Individual	62.5	67.2	8.6	15.5
Female-Headed Single-Parent Family	63.3	51.8	5.9	10.6
Female Unrelated Individual	48.5	65.7	8.2	10.9
All Families and Unrelated Individuals	73.7	73.0	100.0	100.0

[*] The percentages reported in this table pertain to the population of families with principal earners who have positive earnings, and do not apply to the population of all families.

Table 12
Trend Regressions for the Total Family Earnings and the Earnings of the Principal Earner Distributions [*]

	Total Family Earnings			Principal Earner		
	LC	MC	UC	LC	MC	UC
Trend Coeff.	.0015	-.0031	.0022	.0014	-.0024	.0010
	(.0003)	(.0002)	(.0002)	(.0004)	(.0004)	(.0002)
Trend Coeff. Without Cycle	.0013	-.0032	.0018	.0010	-.0025	.0009
	(.0006)	(.0005)	(.0004)	(.0007)	(.0008)	(.0004)

[*] The dependent variable is the class percentage series for either the lower (LC), middle (MC), or upper (UC) class, for either the total family earnings or principal earner distributions.

NOTES

1. The correspondence between the income of a family and its well-being is only approximate. Several pecuniary and nonpecuniary factors are omitted in the analysis, such as cross-family variations in wealth, variations in price levels across regions of the country, etc. We also treat each family identically, though some otherwise-equivalent families may receive higher levels of utility from a given level of income than other families. Families also differ in their income needs, e.g., larger families tend to need more income than smaller families to enjoy the same standard of living. This latter factor is taken into account later in the paper.

2. The actual restriction is that only individuals with positive earnings in the calendar year preceding the survey are included in the population. This excludes those individuals who only "worked without pay."

3. This conclusion is supported by a regression of the Gini coefficient on a constant and a time trend; after correcting for first-order serially correlated errors, the estimate of the trend coefficient for the earnings distribution was .00004, with standard error 0.00031. Including the adult male unemployment rate on the right-hand side as a proxy for business cycle effects, the estimate falls to -.0001, with standard error the total family income distribution; without the unemployment rate the estimated trend coefficient is .0013 (.0003), while controlling for the cycle results in a coefficient estimate of .0005 (.0006).

4. For a discussion of the theory of household production, see Becker (1981).

5. These statistics refer to the labor force activity in the calendar year prior to the year in which marital status is measured.

6. Another important aspect of a researcher's analysis is the dataset he uses. However, for the studies reviewed in this section, and for the empirical work in this paper, either the March or the May Current Population Surveys served as the primary source of data. Since the CPS does not differ by month in its method of sampling, it is doubtful that much of the differences in conclusions drawn by different studies are the result of differences in the datasets analyzed.

7. A year-round worker is defined as an individual who was employed at least 50 weeks in the previous year; a full-time worker is defined as an individual who works at least 35 hours per week.

8. The sample used by Henle and Rsycavage for their wage and salary distributions only includes wage and salary workers who are employed at the time of the survey. These results are not discussed here.

9. Henle and Rsycavage also use the share of income received by the bottom 10 percent, the top 10 percent, and the top five percent, in

calculating their inequality measures. Gastwirth (1972) shows that there is a problem in the Census Bureau's method of calculating Gini coefficients from grouped data (mainly due to the fact that their method does not incorporate information on the average level of income within the relevant groupings) which, for most conventional income distributions, causes their estimates to be biased upward (relative to the Gini coefficient one would calculate from individual-level data).

10. Prior to 1976, March CPS data contain information on weeks worked in the previous year only in a coded interval form, e.g., one-to-fifteen weeks, etc. Dooley and Gottschalk do not discuss how they construct a weekly earnings variable from annual earnings and a coded weeks variable.

11. For more information on the Census Bureau's imputation procedure, known as the "hot deck" method, see David, et. al., (1986).

12. The Bureau of Labor Statistics also provides "population weights" that account for both the sampling scheme used and the tendency of the CPS to oversample certain demographic groups. The Census Bureau advises that these weights be used in calculating population averages involving incomes. None of the articles discussed in this section mention use of the weights (though the grouped data used by Henle-Rsycavage were most likely computed using a procedure that takes account of the weights.)

13. In a later study, Bluestone and Harrison (1986) compare the earnings distributions among all workers in 1978 and 1984, and find that most of the "job growth" over that six-year period occurred at the lower end of the distribution. No evidence is presented on the sensitivity of this result to Bluestone and Harrison's choice of years.

14. The fact that they find decreasing inequality for 1964-1978, a period during which employment was also shifting to the service sector, leads one to question why this explanation should be given such importance. Indeed, Urquhart (1984) shows that the shift from goods to services may have been more rapid from 1967 to 1972 than it was from 1977 to 1982.

15. Since the income cutoffs for the females depend on the male, not the female, median level of earnings, part of the increase for females reflects the rise of female-male wage ratios by 1983.

16. This conclusion is confirmed by McMahon and Tschetter (1986) who show that whatever changes there were in the inequality of weekly earnings were due largely to changes within occupations, and not to employment shifts toward occupations with relatively high and relatively low average levels of earnings.

17. Medoff excludes public-sector and agricultural employees, and includes part-time workers.

18. However, in all six years analyzed, inequality in the nonmanufacturing sector is substantially higher than in the manufacturing sector.

19. Actually, these two analyses still differ on two accounts: (1), Harrison, et. al., analyze wage and salary income, while Plotnick uses all earned income; and (2), Harrison, et. al., calculate the variance of logarithms using individual-level data, while Plotnick uses grouped data.

20. Since the use of imputed incomes is assumed when the BLS computes its weights (see note [12]), omitting observations with imputed incomes is tantamount to changing the weights used in the analysis.

21. The lowest real value for the top-coded level of earnings occurs in the March 1981 CPS (pertaining to income in 1980). The following year, the nominal value of the top-code was raised to 75,000 dollars; in 1985 it was raised to 99,999 dollars.

22. The mean logarithmic deviation, proposed by Theil (1967), is the logarithm of the ratio of the arithmetic mean of income to the geometric mean of income. These measures, and their properties, are discussed more fully in Blackburn (1987).

23. The trend coefficients at the bottom of Table 3 are the estimated values of b_1 and b_2 in the following equations:

$$I(t) = a_1 + b_1 * t + e_1(t) \quad \text{- trend}$$

$$I(t) = a2 + b2*t + c*U(t) + e2(t) \quad \text{- trend without cycle}$$

where I(t) is the level of inequality in year t, and the error terms e1(t) and e2(t) are assumed to be normally distributed, and to follow an AR(1) process. U(t) is the adult male unemployment rate in year t.

24. It also implies that there has not been an outward shift of the Lorenz curve over time, which would occur if and only if there had been an unambiguous increase in inequality (see Rothschild and Stiglitz, 1973).

25. Our results are not directly comparable to those of Henle and Rsycavage because we use individual, not grouped data, and because we use consistent top-codes on earnings. However, the trend in our Gini coefficients mirrors the movements reported by Henle and Rsycavage for the 1967-1977 period. Our findings do not concur with those of Harrison, Tilly, and Bluestone.

26. Blackburn shows that an increase in the covariance of education and age among males and a rise in the return to schooling were also important factors in this rise.

27. To the extent that hourly wage rates depend on the number of hours supplied by workers, the distribution of wage rates is not completely purged of labor supply influences.

28. The industry employment shares in 1967 and 1984 were as follows:

Industry	1967	1984
Manufacturing	30.0	22.3
Other Goods	10.7	8.9
Traditional Services	13.2	16.4
Trade	16.9	17.6
Services	22.1	28.4
Public Administration	7.0	6.4

For a definition of the industry categories, see the footnote to Table 6.

29. These results are consistent with those reported by Medoff, who analyzed hourly wage rates using a manufacturing/non-manufacturing breakdown.

30. The mean logarithmic deviations for the individual industries are not presented here, although they exhibit patterns and trends that are qualitatively similar to those presented for the Gini coefficient. Unfortunately, the Gini coefficient does not possess the same decomposition property as the mean logarithmic deviation.

31. Pechman provides evidence that tax rates have declined for the top decile of the income distribution, due to the decreasing importance of the corporate income tax and the property tax. This finding strengthens our conclusion that the upper part of the distribution has become increasingly skewed over time.

32. Levy and Michel (1983) analyze the effects of tax system changes on after-tax income inequality for the years 1981 to 1984 and find the tax system to have changed so as to increase income inequality. However, unlike Pechman, their analysis fails to include corporate income taxes. They also do not explore the extent to which their results are sensitive to the particular assumptions they make concerning the incidence of various taxes.

33. The principal earner is defined as the head of household for those families in which this concept is not ambiguous, i.e., for families not headed by a married couple. For married-couple families, the spouse with the higher earnings is defined as the principal earner.

34. Before the 1980 CPS, the head of household was always an adult male if there was one present in the household. After 1980, the designation of head of household was made by the survey respondent.

35. In 1985, the population of female unrelated individuals consisted of more young, divorced females than it did in 1967 when a female living alone was more likely to be older and widowed.

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