Inflation, Recession and Personal Income Distribution

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I. Introduction

There are several theories to explain how inflation can affect inequality in personal size income distribution:(1) (1) Under the familiar debtor-creditor wealth transfer hypothesis, debtors will gain because the real value of debts and interest payments will decrease as the level of prices rises. If the debtors are the low and middle income groups, and the creditors are the high income groups, then inequality will decrease during inflation. If the debtors and creditors are reversed, then inequality will increase. However, if the wealth transfer takes place within groups, the effect will be neutral. Also, if the expectation theory is effective, increases in the rate of interest will offset the wealth transfer effect.

(2) According to the wage-lag hypothesis, money wage rates tend to lag

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(1) For the studies on the wage-lag hypothesis, see Alchian and Kessel [2], Cargyill [12].
For the debtor-creditor wealth transfer hypothesis, see Alchian and Kessel [3], Bach and Stephenson [6], and Basel and Globerman [7].
For the expectationists hypothesis, see various monetarists arguments on the Phillips curve. Also see Turnovsky and Wachter [30]. However, these studies are not concerned with personal income distribution.
For a recent survey on studies on personal income distribution, see Sabota [27].

behind the level of prices. Then, during inflation, wage earners will lose and the profit takers will gain. Since wage earners tend to belong to a lower income group than the profit takers do, income inequality will tend to increase during inflation. However, as the expectationists argue, if anticipated inflation is fully absorbed in the current rate of increase in money wage rates, there will be no wage-lag, and thus income distribution will not be affected by inflation.

(3) According to the Phillips curve hypothesis, an increase in the rate of inflation is often accompanied by an increased demand for labor and thus employment. As unskilled marginal workers are employed, the absolute and relative income shares of low income groups increase; income inequality decreases. The situation may be explained from the supply side of labor. When the level of prices rises rapidly, the real income of the workers decreases rapidly. To supplement the falling real income of families, the rate of labor participation increases among the low income groups, and increased employment is made possible by the rising demand for labor. In such a situation, employment can increase without decreasing the rate of unemployment, and by maintaining the real wage rate constant. However, the empirical significance of the effect of inflation on the relative wage share of the workers and thus their relative income share would depend upon the elasticity values.[2] However, the expectationists argue that the rate of unemployment is independent of the rate of inflation.

(4) According to the fixed income hypothesis, many people in the low income group are fixed income recipients, such as retired aged people. During the period of inflation, their real income decreases most rapidly, and thus income inequality increases during inflation. However, the fixed income effect may be partially offset by increases in benefit payments

(2) Assume that the low income group's income is equal to wage share. Let the relative wage share be:

$$k = w\,N/Q \tag{1}$$

where w=the real wage rate, N=the number of wage workers, Q=the real GNP. Assuming w, N, and Q are all functions of the level of prices, differentiating with respect to P, and multiplying by PQ/wN, we obtain:

$$\frac{dk}{dP}\,\frac{P}{k} = \frac{dw}{dP}\,\frac{P}{w} + \frac{dN}{dP}\,\frac{P}{N} - \frac{dQ}{dP}\,\frac{P}{Q} \tag{2}$$

Equation (2) may be further rewritten as

$$\frac{dk}{dP}\,\frac{P}{k} = \frac{dw}{dP}\,\frac{P}{w}\left(1 + \frac{dN}{dw}\,\frac{w}{N} - \frac{dQ}{dN}\,\frac{N}{Q}\cdot\frac{dN}{dw}\,\frac{w}{N}\right) \tag{3}$$

adjusted by cost of living indexes, and by increases in the insurance premium payments made by the non-retired workers.

(5) Inflation-hedging investment hypothesis. The debtor-creditor wealth transfer hypothesis applies to the wealth transferred between the debtors and creditors during inflation. But, according to the inflation-hedging investment hypothesis, differentials in gains in wealth and income can also depend upon what types of assets and investments a person holds during inflation. Assuming that the inflation-hedging assets are more expensive than the non-inflation hedging assets, only the people in the high income group can afford to buy such inflation-hedging-assets, and-people in low income groups could buy mainly non-inflation hedging assets. Given that the two rates of return on investments are equal in the absence of inflation, the holders of inflation-hedging assets will gain more than the holders of non-inflation hedging assets during inflation, and income inequality will increase. Such inflation-hedging assets may include land, houses, gold, diamonds, jewels, certain foreign currencies and securities, commodity and security future contracts, and certain corporate stocks. Non-inflation hedging assets include savings accounts, corporate and government bonds, and certain corporate stocks.[3]

The major objective of this paper is to test the empirical significance of the rate of inflation in influencing the personal income distribution and thus income inequality. In the following section, previous studies are briefly reviewed. In the third section, the model and the methods of measuring income inequality are reviewed. In the fourth section, the hypotheses and the regression results are presented. In the fifth section, the trend and the cyclical fluctuations of income distribuiton are discussed. The final section consists of a summary and conclusions.

II. Previous Empirical Studies

In reviewing previous econometric studies on the effect of inflation on personal income distribution, only three regression studies and one simulation study were available. In Metcalf's regression analysis [22], the dependent variables are the relative mean incomes of six types of families:

(3) Budd and Seiders [9] classified net worth and income in terms of adjustment coefficients. An inflation-hedging asset would have a higher coefficient than a non-inflation hedging asset.

(1) the top decile of families with a male head, wife in the labor force; (2) wife not in the labor force; (3) the bottom decile families with a male head, wife in the labor force; (4) wife not in the labor force; (5) the top decile families with a female head; and (6) the bottom decile familes with a female head. The relative mean incomes are defined as follows: (1) for the bottom deciles, the income level at bottom decile cut-off divided by median income for families with a male head; (2) income level at 15.87% percent quantile cut-off for families with a female head; (3) for the top decile families, the income level at top decile cut-off divided by median income for families with a male head; and (4) the income level at 84.13 percent quantile cut-off for families with a female head.

The independent variables included the wage and salary payments per employee, the unemployment benefit payments per person, the rate of unemployment, the rate of employment, personal income per capita, government transfer payments per capita, interest and divided income per capita, corporate profits and capital consumption allowances as a percent of gross private product, labor force participation rate, the rate of change in annual wage rate, current dollars, the time trend, and others. All income-related variables above were, except for the rate of change in money wage rates, measured in 1958 constant dollars. Although the rate of inflation was not included as an independent variable in his regression equations, Metcalf interpreted that given the real level of all income components (including wage income), an increase in nominal wages was equivalent to a change in prices. In effect, he concluded that increases in real wages and employment tended to improve the relative position of low income families which are labor force oriented, and to lower the relative but not the absolute position of high income families. Increases in the price level had a parallel effect. But an exception was that the upper tail of families with a male head and wife in the labor force also improved. He used the U.S. time series data for 1949~65.

In the same year as Metcalf, Schultz [28] presented a more simple and clear regression equation using the U.S. time series data for 1944~65. He regressed the Gini ratio on the rate of inflation, the rate of growth in real output, the rate of unemployment and the time trend. He found that the rate of inflation had a negative sign, but was not significant. The only

significant variable was the time trend which had a positive sign. However, for the Netherland data for 1956~59, all the independent variables were significant. The rate of inflation had a negative sign, suggesting that the rate of inflation decreased the Gini ratio or income inequality. But the time trend variable had a negative sign, which is contrary to the U.S. case.

Schultz speculated that the insignificant results for the U.S. data could have resulted from sampling variability in the underlying data and the shortcomings of the procedure used to estimate income concentration from the grouped data.

Hollister and Palmer [19] showed some regression results in their extensive poverty study. They used time series data for the period, 1947~66. The dependent variable was the percent of population in poverty, and the independent variables were the time trend, the rate of unemployment, and the rate of change in consumer prices. The rate of unemployment had a positive sign, and the time trend and the rate of change in prices had negative signs. But the rate of change in prices was not significant. Since the Durbin-Watson statistic indicated serial correlation, they recalculated a regression equation with the above variables in first order differences. The results showed that the time trend and the rate of change in prices had negative signs and were significant, and the rate of unemployment had a positive sign and was significant. Also they calculated regression equations in semi-log and double log forms with the above variables in first order differences. The results were very similar. That is, the rate of inflation showed negative signs, and they were significant.

In addition to the above regression equations, Hollister and Palmer studied five types of effects of inflation on poor families: (1) Expenditure effect. The prices of goods and services poor families tend to pay (poor man's price index) increased less rapidly than the general level of prices. (2) The effect on fixed income earners. Contrary to popular belief, only a small percentage of poor families received money from pensions, annuities, and other forms of fixed value income. (3) Transfer payments. Historically, the average public transfer payments, which are the second important income source for the poor families, have risen faster than enough to offset the rise in consumer price indexes, and in most cases, have risen faster than disposable per capita income. (4) Wealth effect. The assets of the poor

families were very small in real value and the proportion vulnerable to inflation was a small proportion of these small assets. (5) Employment and income effect. During the period of inflation, the labor force participation rate rises, and the rate of unemployment falls for the poor families. Also, the part-time employment status tends to change to the full time employment status. During the period of inflation, due to tighter labor markets, both absolute and relative income shares of the poor families rise, and the wage differentials narrow in favor of the poor workers.

In their simulation study, Budd and Seiders [9] began by developing the concept of adjustment coefficient or the price elasticity for each component of income and net worth. The net worth components include common stocks, equity in farm and non-farm businesses, investment in real estate, owner-occupied homes, checking and savings accounts, mortgages, loans and other debts. Income components include wages and salaries, dividends, interests on various types of bonds, rental income, transfer payments, pension annuities, etc. They considered four types of income concepts.

Second, Budd and Seiders ranked consumer units by the size of net worth or income. Then they simulated inflation rates of 2% and 5% on each component of net worth or income. Finally, percentage changes in each quantile's income, net worth, and in its share of total income or net worth were computed, and the effect of the simulated inflation on different parts of the size distribution were determined.

The results were that the effect of simulation on the size income distribution was relatively small. However, for instance, for money income shares, the lower groups and the upper tail have lost relative to middle groups in terms of shares. For the 5% inflation case, the relative share of the bottom two quantiles and of the top 4% were reduced by 0.7% and 0.5% respectively, whereas the share of the quantiles composing the 41st through the 96th percentile was increased by 0.25%. Budd and Seiders used 1962 survey data for income and asset holdings.

Thus far we have studied four empirical studies by Metcalf, Schultz, Hollister and Palmer, and Budd and Seiders. In comparing their results, it should be noted that each study has different explained variables. Only Schultz considered the over-all effect of inflation on the summary measure of income inequality. Hollister and Palmer concentrated on the poor

families. Metcalf, and Budd and Seiders examined the quantile income groups. The differences in the results of Metcalf, and Budd and Seiders are mainly due to the fact that Budd and Seiders ignored the effect of inflation on employment. However, Metclaf's regression equations are too much complicated for straight interpretations, and he did not include the rate of inflation explicitly in his regression equations.

This study is different from the previous studies in the following points: (1) the data period is much longer; (2) the rate of inflation is explicitly included in the regression equations, and (3) various measures of income inequality are tested.

III. The Model and Measurement of Income Inequality

The objective of this paper is to test the effects of inflation on personal income distribution. However, we have to clarify two things; first, the means by which inflation can influence the size distribution, and second, the meaning or the measurement of inequality in income distribution. These two questions may be clarified in the following:

Assume there are two persons in the society. The two person's income equations are given below:

$$Y_1=w_1L_1+i_1K_1+T_1+e_1 \tag{1}$$
$$Y_2=w_2L_2+i_2K_2+T_2+e_2 \tag{2}$$

where Y=total income of each person, w=the wage rate, L=labor hours, K=asset or wealth, accumulated and/or inherited, i=the rate of return on the asset; T=private and government transfer payments, and e=the chance variable. The subscripts 1 and 2 stand for persons 1 and 2.

From equations (1) and (2), the relative income shares may be derived:

$$\frac{Y_1}{Y_1+Y_2}=\frac{w_1L_1+i_1K_1+T_1+e_1}{w_2L_2+i_2K_2+T_2+e_1+w_2L_2+i_2K_2+T_2+e_2} \tag{3}$$
$$\frac{Y_2}{Y_1+Y_2}=\frac{w_2L_2+i_2K_2+T_2+e_2}{w_1L_1+i_1K_1+T_1+e_1+w_2K_2+i_2K_2+T_2+e_2} \tag{4}$$

From equations (3) and (4), we may write:

$$\frac{Y_1}{Y_1+Y_2}=F(w_1/w_2, L_1/L_2, i_1/i_2, K_1/K_2, T_1/T_2, e_1/e_2) \quad (5)$$

$$\frac{Y_2}{Y_1+Y_2}=F(w_1/w_2, L_1/L_2, i_1/i_2, K_1/K_2, T_1/T_2, e_1/e_2) \quad (6)$$

Equations (5) and (6) state that the relative income share is a function of the relative wage rate, the relative labor hour, the relative rate of return on capital, the relative capital asset, the relative transfer payment, and the relative luck. (4)

These relative variables may be influenced by various factors. Some of them may include: education, age, sex, racial discrimination, personal characteristics such as friendliness, beauty, physical strength, talent, ability, a good voice, sincerity, the fortune of having wealthy parents, the fortune of working with a broad minded boss who is willing to give a raise and a promotion, geographical region such as the southern U.S. where racial discrimination is most conspicuous, and where culture and economy are underdeveloped and so on. (5)

Of these, the socio-cultural variables do not change drastically in a short run. However, economic conditions change very rapidly during a business cycle, and a change in economic conditions will change the wage rate, the employment status, labor hours, the rate of return on capital assets, and the value of capital assets. Thus, Equations (5) and (6) may be rewritten as functions of trend and cyclical economic variables. For instance:

$$\frac{Y_1}{Y_1+Y_2}=F(N/E,\ \Delta P/P,\ U,\ \Delta Q/Q, \ldots\ldots, e) \quad (7)$$

$$\frac{Y_2}{Y_1+Y_2}=F(N/E,\ \Delta P/P,\ U,\ \Delta Q/Q, \ldots\ldots, e) \quad (8)$$

where N/E=the percent of employed workers, $\Delta P/P$=the rate of inflation, U=the rate of unemployment, $\Delta Q/Q$=the rate of growth in real output, and e=the error term.

(4) Equations (5) and (6) may be rewritten in the following format:
$Y_1/(Y_1+Y_2)=F(w_1L_2/w_2L_2,\ i_1K_1/i_2K_2,\ T_1/T_2,\ e_1/e_2)$
When, for instance, $K_1=0$, K_1/K_2 and i_1K_1/i_2K_2 should be reduced to $1/K_2$, and $1/i_2K_2$ respectively.

(5) For studies which include education and other "human variables," see Chiswick [13], Chiswick and Mincer [14], Adams [1], Houthakker [20], and Mincer [23].

Granted that changes in economic conditions affect the wage rate, employment status, the rate of return and the value of assets, the question is how the relative wage rate, the relative work hour, the relative employment status, the relative rate of return and the relative value of assets can change as a result of changes in the economic conditions. This point will be discussed in the following section.

Before we proceed further, the above equations may easily be generalized for n persons and/or k groups. Assume there are k groups. Then the relative income share of the i th group is given by

$$\frac{Y_i}{\sum_{i=1}^{k} Y_i} = y_i (i=1.....k) \tag{9}$$

where Y_i=the mean income of the i th group, and y_i=the relative percentage share of income by the ith group.

Another popular measure of unequal income distribution is the variance of the logarithmic income, which is defined as follows:

$$\mathrm{Var}(ln\ Y)=\sum_{i=1}^{k}(ln\ Y_i-ln\ \bar{Y})^2/K=\sum_{i=1}^{k}[ln(Y_i/\bar{Y})]^2/K \tag{10}$$

Perhaps the most popular measure of unequal income distribution is the Gini ratio, which is defined as:

$$GR=[0.5-\sum_{i=1}^{k}\Delta n_i(y_{i+1}'+y_i')/2]/0.5=1.0-\sum_{i=1}^{k}\Delta n_i(y_{i+1}'+y_i') \tag{11}$$

where $y_i'=y_1+y_2.....+y_i$

=the cumulative percentage of income through the ith group.

Δn_i=the percent of population in the ith group

The Paglin's [25] Gini ratio is defined as:

(Lorenz Gini ratio)−(Age Gini ratio)=Paglin's Gini ratio (12)

The age Gini ratio is calculated in a similar way as the Lorenz Gini ratio is except that age groups are ranked by the mean incomes.

The relative mean income ratio is defined as the quantile's share of income divided by the percentage of population in the quantile. In graphical

terms, it is the slope of the chord connecting the lower and upper limits of the quantile on the Lorenz curve. If the quantile size is very small, the mean income ratio is the slope of the Lorenz curve itself (Budd [10]).

$$RR=\Delta Y_i/\Delta N_i \tag{13}$$

where RR=the relative mean income ratio
ΔY_i=the percentage share of income of the ith quantile
ΔN_i=the percentage share of population in the ith quantile

It is well known that each measure has advantages and disadvantages. The Gini ratio, for instance, is simple to calculate, but it is insensitive to the Lorenz curve as long as the area of income inequality remains constant. Likewise, the variance of the logarithmic income is based on the assumption of lognormal distribution of income, but the lognormal distribution does not provide a good description of the upper tail of the practical distribution. The percentage shares of quantiles and the mean income ratio are not summary measures of income distribution.(6)

IV. The Hypotheses and the Regression Results

In the previous section, we have seen that the relative income share depends upon various relative varibles and that these relative variables may be influenced by economic variables. Equations (5) and (7) may be reproduced below:

$$E_i=F(w_1/w_2,\ L_1/L_2,\ i_1/i_2,\ K_1/K_2,\ T_1/T_2,\ e) \tag{14}$$

$$E_i=F(N/E,\ \Delta P/P,\ U,\ \Delta Q/Q,\ E_{t-1},\ e) \tag{15}$$

where E_i=income inequality measures: the percentage share of income by quantiles, the Gini ratio, the Paglin's Gini ratio, the variance of the logarithmic income, and the mean income

(6) For a more rigorous discussion of disadvantages of these and other measures of income inequality, see Atkinson [4, 5].

In this paper, we have tested the above four types of income inequality measures. Other inequality measures, which can be tested if data are available, include the following: Pareto's [26] α, Bowman's α, the relative mean deviation (Yntema, [35]; Schutz, [29]; Elteto and Frigyes [16], Dalton's [15] ratio, and Atkinson's [4] ratio). See Appendix note.

ratio.

N/E=the percent of employed workers or "hired" workers in total employment. Thus, $1-N/E$ gives the percent of self-employed workers in total employment.

$\Delta P/P$=the rate of inflation in consumer prices.

U=the rate of unemployment.

$\Delta Q/Q$=the rate of real GNP growth.

E_{t-1}=the dependent variable with one year time lag.

e=the error term.

The data sources for the dependent variables, i.e., the inequality measures, are explained in the footnote of Table 1. The independent variables are obtained from the U.S. Council of Economic Advisors, *Economic Report of the President*, 1978.

Equation (15) is the model we wish to test. However, before we present the statistical results, it may be useful to discuss how each of the economic variables in Equation (15) can influence the relative variables in Equation (14) and thus influence income distribution. It should be noted that in our model, income distribution can be changed only through changes in the relative variables in Equation (14).

(1) First, an increase in the percent of employed workers in total employment is expected to reduce income inequality, since the income gap between the employed workers and self-employed workers will be reduced as the percent of employed workers increases. Similary, as the percent of agricultural workers and the percent of government workers increase, the wage gap may tend to decrease. So increases in these variables would reduce income inequality.[7]

(2) Second, as to the possible effects of inflation, we have already briefly discussed in Section I. However, it may be useful to discuss these once again here for further clarification of those hypotheses since inflation is the most controversial variable in current economic theory and policy as

(7) In preliminary regression equations, we have included the following variables also: the government employment ratio, the agricultural employment ratio, and the time trend. All these variables had very close correlations with the percent of employed workers. So we have chosen the percent of employed workers and excluded the other variables to minimize multicollinearity.

well. According to the classical theory and the expectationists hypothesis, the level of prices cannot influence real variables nor the relative variables in the long run. They argue that when the level of prices doubles, all other variables will also double and thus the relative variables will not be affected. However, the following hypotheses challenge the above view:

(a) According to the wage-lag hypothesis, money wage rates tend to lag behind the level of prices. Thus the relative profit share increases and the relative wage share decreases. Since the profit takers are high income groups, income inequality increases. In Equation (14), this implies that the relative wage rate and the relative rate of return on assets change in favor of high income groups.

(b) According to the debtor-creditor wealth transfer hypothesis, when the level of prices rises, the real values of debt and interest payments decrease. So the debtors gain and the creditors lose. But it is not clear how this can affect inequality in income distribution. One possibility is that the debtors invest the borrowed funds in assets whose values rise more rapidly than the level of prices, and they pay off later interest and principal whose face values have been held constant. In such a case, the debtors gain more than the creditors, and income distribution will be in favor of debtors. However, if the creditors anticipate inflation, and charge higher interest rates to compensate for the loss of the purchasing power, the wealth transfer effect may not take place.[8]

(c) According to the inflation-hedging investment hypothesis, another reason why inflation can affect income distribution is that people hold different types of assets: Inflation-hedging assets and non-inflation hedging assets. For example, people are aware that cash, savings accounts, or bonds are less favorable financial assets than inflation-hedging assets such as land, houses, gold, certain currencies and securities, commodity and security

(8) For instance, assume that a debtor borrows $100, and purchases a $100 value asset. In the absence of inflation, the creditor charges interest rate of 10%. Further assume that there was an unanticipated inflation of 15%, and the asset value increases to $115. The debtor will gain $5 net of interest payment. In order to take away the debtor's windfall gain, if the creditor correctly anticipated inflation rate of 15%, and increased the interest rate to 15%, there would be no windfall gain for the debtor, and income distribution will not be affected through the debtor-creditor wealth transfer route. However, neither such a perfect anticipation nor such an immediate adjustment of interest rate to inflation may be possible in reality.

future contracts, and certain corporate stocks. Still some people would choose holding non-inflation-hedging assets to avoid risk and to keep liquidity. Also, inflation-hedging assets tend to be more expensive and require a large amount of investment fund. Thus, during inflation, people who hold such inflation-hedging assets will obtain a greater return, in the forms of annual income and/or capital gains, than those who do not hold such assets. Usually, the high income groups can afford to purchase such inflation-hedging assets. Consequently, the relative rate of return on assets will change during inflation in favor of the high income groups, and thus income inequality will increase during inflation.(9)

(3) Third, so much for the rate of inflation, we may now discuss the rate of unemployment which may be the most significant variable in influencing inequality in income distribution. The high income groups may obtain income through both labor and property, while low income groups are mainly dependent on labor income. Thus unemployment will eliminate the major source of income for the low income groups, and income inequality will increase.

(4) Fourth, during a period of high economic growth, the demand for labor increases and thus unskilled marginal workers may obtain employment. As a result, inequality in income distribution will decrease. However, if the rate of real GNP growth is taken as a proxy for the profit share or the rate of profit, income inequality will increase as the real GNP growth rate increases.

(5) The dependent variables with one year of time lag are included to increase the predictability of regression equations. However, they may have

(9) Assume that investor 1 invests in an inflation-hedging asset for $1,000. The rate of return on the asset is 10%. He will receive annual income of $100. Assume investor 2 invests in a fixed value asset, the rate of reurn being 10%. He will alsc receive $100 of annual income. In the absence of inflation, the two investments would not make any difference with regard to the annual income. However, assume that the level of prices rises by 10%. The value of the inflation-hedging asset will rise to $1,100, and the annual income will rise to $110, i.e., $1,100×0.1=$110, $10 more income than investor 2. If investor 2 fully anticipated 10% of inflation rate, he could have raised the rate of interest to 11%, and his annual income will be $110. Then investor 1 would raise his required rate of return to 11%, and his annual income should rise to $1,100×0.11=$121. If he sells the asset the capital gain will be $100. So total gain of investor 1 is $121+$100=$221, compared with investor 2's gain of $110. To obtain the same return as investor 1, investor 2 must increase the rate of interest to 22.1%.

a real economic meaning as well. That is, each family may aim to maintain at least the previous year's income level and thus the previous year's relative income share. In this event, the current income share may be related to the previous year's income share.

With the above five variables, by the method of ordinary least squares, a large number of regression equations were computed with various combinations of the variables. Some of the regression results are summarized in Table 1. The following points may be noted:

(1) First, the rate of inflation is significant in Equations 1, 4, 6, and 8. The results suggest that inflation tends to increase the relative income shares of the lowest 5th group and the top 5% of families, but it tends to decrease the relative income share of the fourth 5th. The above results are very similar to those of Metcalf [22], as mentioned previously. However, the above results apparently demand careful interpretation, since it is apparent that no single one hypothesis is sufficient to explain the diverse effects of inflation on different groups.

In order to explain the gain in the relative income share by the lowest 5th group during inflation, the Phillips curve hypothesis is helpful. That is, during the period of inflation, the demand for labor and thus employment tends to increase. As the marginal unskilled labor is employed, the absolute and relative wage shares of the lowest income group rise. Or, it may be argued that during a period of rapid inflation, the real income of low income families falls rapidly. To supplement the falling real income of families, the labor force participation rate increases rapidly among the low income groups. And this increase in employment is made possible by the rising demand for labor during a period of inflation. It should be noted that according to this interpretation, the relative income share of the low income group can increase only if inflation is accompanied with an increasing demand for labor.[10]

(10) Assume that the relative income share of the low income group is given by

$$k=\frac{w_1L_1}{w_1L_1+w_2L_2}$$

If the employment of the low income group rises during inflation, the relative income share of the low income group will rise. We assume that the employment of the high income group does not change because they are already fully employed:

$$\frac{\partial k}{\partial L_1}=\frac{w_1w_2L_2}{(w_1L_1+w_2L_2)^2}>0$$

In order to explain the decreases in the relative income share of the middle income groups and the increases in the relative income share of the top 5% group, we must refer to wage-lag hypothesis, the debtor-creditor wealth transfer hypothesis, and the inflation-hedging investment hypothesis. During the period of inflation, money wage rates tend to lag behind the level of prices, and thus the relative share of wage earners, including the middle income groups, decreases; and the profit share, which goes to the top 5% group, increases. It may be also hypothesized that the middle income groups are creditors, and hold fewer inflation-hedging assets than the top income group who holds large amounts of inflation-hedging assets such as real estate, gold, diamonds, and other physical assets as well as stock and bonds. Thus during the period of inflation, the middle income groups lose and the top income groups gain in their relative income shares. According to the above interpretation, it appears that all three hypotheses are useful in explaining the diverse effects of inflation on different income groups.

For other measures of income inequality, the rate of inflation is significant only for the variance of the logarithmic income. The negative sign suggests that inflation decreases income inequality. This result is consistent with the results of Equation (1) in Table 1, which suggests that inflation tends to increase the relative share of the lowest 5th group. The insignificance of inflation for the Gini ratio measure of income inequality may be partially explained by the fact that the Gini ratio is insensitive to the shapes of the Lorenz curve as long as the area of the Lorenz curve is constant.

(2) Second, the rate of unemployment has negative signs and is significant for the relative shares of the lowest 5th and the second 5th groups. Obviously, the lowest 40% of the population depends mainly upon labor for their incomes. When unemployed, its absolute income share, as the relative income share, will fall. However, for the middle 5th group, the rate of unemployment has a negative sign, but is not significant. This implies that the over-all rate of unemployment has little effect on the rate of unemployment among the middle 5th group. That is, the people in that group are likely to be fully employed regardless of business cycles. Since the two

Also, it should be noted that employment can increase without decreasing the rate of unemployment when the labor force participation rate also increases at the same time.

Table 1. Determinants of Income Inequality (1947-76)

	Intercept	N/E (84.41%)	$\Delta P/P$ (3.69%)	U (4.99%)	$\Delta Q/Q$ (3.37%)	Lagged dep. $(t-1)$	R	$\bar{R}^2$	F	DW	SEE	h
Percentage Share of Lowest 5th (5.10%) (1)	0.0134 (0.59)	0.0351 (4.14)*	0.0264 (3.43)*	−0.0334 (−1.78)*	0.0199 (2.06)*	0.4177 (3.19)*	0.9454	0.8716	40.38	1.55	0.1252	1.77
Percentage Share of Second 5th (12.15%) (2)	4.4267 (161.33)	−0.0006 (−0.08)	0.0098 (0.80)	−0.0745 (−2.91)*	0.0233 (1.63)	0.6606 (3.60)*	0.8098	0.5840	9.14	2.03	0.1503	na
Percentage Share of Third 5th (17.61%) (3)	8.7157 (250.30)	0.0133 (1.16)	−0.0199 (−1.37)	−0.0216 (−0.76)	0.0066 (0.47)	0.4607 (2.80)*	0.7717	0.5113	7.07	2.48	0.1907	−3.06
Percentage Share of Fourth 5th (23.77%) (4)	14.9383 (534.88)	0.0246 (2.89)*	−0.0248 (−2.66)*	0.0401 (1.55)	−0.0135 (1.64)	0.2818 (1.64)	0.8417	0.6478	11.67	1.86	0.1530	1.16
Percentage Share of Highest 5th (41.38%) (5)	22.7033 (319.65)	−0.0549 (−1.76)*	0.0090 (0.29)	0.1325 (2.30)*	−0.0293 (−0.88)	0.5480 (2.85)*	0.8792	0.7257	16.35	2.04	0.3890	na
Percentage Share of Top 5% (16.10%) (6)	24.3220 (330.47)	−0.1108 (−3.76)*	0.0445 (1.72)*	−0.0074 (−0.11)	0.0233 (0.79)	0.0576 (0.27)	0.8426	0.6496	11.75	2.14	0.4031	na
Gini Ratio (0.337) (7)	0.3514 (337.24)	−0.0011 (−2.88)*	−0.0002 (−0.43)	0.0015 (1.74)*	−0.0004 (−0.87)	0.2121 (1.04)	0.7965	0.5582	8.33	1.90	0.0057	na
Paglin's Gini Ratio (0.269) (1947-72) (8)	0.3282 (238.20)	−0.0023 (−2.36)*	−0.0006 (−1.07)	−0.0008 (−0.47)	−0.0008 (−1.33)	0.5219 (2.73)*	0.9622	0.9072	49.85	1.57	0.0070	4.98
Var(ln Y) (male, 25-64) (0.618) (1949-69) (9)	0.3024 (72.64)	0.0004 (0.25)	−0.0056 (−2.17)*	0.0152 (2.16)*	−0.0030 (−1.33)	0.3841 (2.05)*	0.9167	0.7872	15.80	1.98	0.0191	0.09
Mean Income Ratio of 4th 5% (0.308) (1944-67) (10)	0.2681 (104.48)	0.0010 (1.34)	0.0009 (0.97)	−0.0056 (−2.72)*	−0.0012 (−1.57)	−0.0549 (−0.25)	0.6531	0.2756	2.83	1.98	0.0128	na

Notes : The numbers in parentheses under the dependent and independent variables are their mean values.

The numbers in parentheses under the regression coefficients are the t-ratios.

* Significant at the 5% level or less.

Unless specified, the regression data are for the period 1946-76.

The Durbin's h statistic was calculated by

$$h=(1-DW/2)\sqrt{\frac{N}{1-N\cdot V(Y_{t-1})}}$$

DW=the Durbin-Watson test statistic

N=the number of observations.

$V(Y_{t-1})$=the variance of the coefficient of the lagged dependent variable

The critical value of h at the 5% level of significane is 1.645.

na=the h statistics is not applicable due to a negative number in the radical.

(See D. Gujarati, *Basic Econometrics*, 1979, pp. 269-70.)

Sources of the Data·

(1) The data for Equations (1)—(6) are taken from the following sources: U.S. Bureau of the Census, *Trends in the Income of Families and Persons in the United States*, 1947-1964, Technical papers 17, 1967, pp. 170-175, for 1947-64. U.S. Bureau of the Census, *Historical Statistics of the United States, Colonial Times to 1970*, Part 1, 1975, p. 293 for 1965-70.
U.S. Bureau of the Census, *Statistical Abstract of the United States*, 98th ed., 1977, and other editions for 1971-76.

(2) The Gini ratio for Equation (7) was calculated from the data given in the above sources by the ordinary linear method of calculating the Gini ratio. This method underestimates the Gini ratio calculated from a larger sample data. Paglin (1975) used the "cubic-spline method" in his paper.

(3) Paglin's Gini ratio for Equation (8) is from Paglin, M., "The Measurement and Trend of Inequality: A Basic Revision," *American Economic Review*, Sept. 1975, pp. 598-609, Table 3.

(4) The variance of logarithmic income for male in ages 25-64 is from Chiswick, B.R., and Mincer, J., "Time Series Changes in Personal Income Inequality in the United States from 1949—, with Projections to 1985." *Journal of Political Economy*, May/June Supplement, 1972, pp. S34-S66, Table B10.

(5) The mean income ratio is from Budd, E.C., "Postwar Changes in the Size Distribution of Income in the U S.", *American Economic Review*, May 1970, pp 247-260, Table 5, for families.

low income groups tend to lose and the middle 5th group tends to maintain their their share when the over-all rate of unemployment increases, the high income groups must gain in their shares to offset the losses by the two low income groups. Indeed, the rate of unemployment has positive signs for the fourth 5th and the highest 5th groups. However, the positive sign is significant only for the highest 5th group. The rate of unemployment has a negative sign for the top 5th group, but it is not significant.

For the other measures of income inequality, the rate of unemployment is significant both for the Gini ratio and the variance of the logarithmic income. This is consistent with the hypothesis that unemployment increases income inequality. The rate of inflation is negative and significant for the mean income ratio of the fourth 5% group, suggesting that their mean income ratio decreases as the rate of unemployment increases.

(3) Third, the percent of employed workers has significant positive signs for the lowest 5th and the fourth 5th groups, but has a significant negative sign for the highest 5th group. It is not significant for the second and the third 5th groups. The results suggest that when the percent of employed workers increases, the lower income groups tend to gain relative to the highest 5th group including the top 5% group. Likewise, the percent of employed workers has significant negative signs for the Gini ratio and the Paglin's Gini ratio, suggesting that when the percent of employed workers increases, income inequality decreases.

(4) Fourth, the rate of increase in GNP is positive and signficant only for the lowest 5th. This result is consistent with the hypothesis that during a period of high economic growth, the demand for labor, and thus employment increases. As the unskilled marginal workers in the lowest income group obtain employment, their absolute and relative income shares increase.

(5) Finally, the lagged dependent variables are significant in 6 equations out of 10. All the significant coefficients have positive signs.

It should be added that the above statistical results are not always complete nor conclusive. For instance, the h statistic indicates that the serial correlation is significant at the 5% level in Equations 1, 3, and 8. The h statistic is not applicable in Equations 2, 5, 6, 7, and 10. The serial correlation is not significant only in Equations 4 and 9. Thus, the true variances

Table 2 Changes in the Relative Income Shares of Quantiles (1947~76)

	Intercept	Δ(N/E)	$\Delta(\Delta P/P)$	ΔU	$\Delta(\Delta Q/Q)$	R	R^2	$\bar{R}^2$	F	DW	SEE
ΔLowest 5th (0.01)	−0.0090 (−0.35)	0.0534 (1.06)	0.0297 (2.98)*	−0.0162 (−0.40)	0.0112 (1.33)	0 7199	0.5182	0 4411	6.72	2 35	0 1420
ΔSecond 5th (0 00)	−0.0428 (−1.56)	0 1026 (1.91)*	0.0131 (1.24)	−0.0454 (−1.05)	0 0053 (0.60)	0.7545	0.5692	0.5003	8 26	2 17	0 1508
ΔThird 5th (0 03)	−0 0323 (−0 80)	0.1077 (1.37)	−0.0052 (−0.34)	0.0259 (0.41)	0.0155 (1.19)	0.4128	0.1704	0 0377	1 28	2 55	0 2203
ΔFourth 5th (0.03)	0 0184 (0.55)	0.0205 (0.32)	−0.0273 (−2.14)*	−0 0074 (−0.14)	−0 0210 (−1.94)*	0 4946	0 2447	0 1238	2 02	2.38	0 1826
ΔHighest 5th (−0 07)	0 0639 (0 87)	−0 2908 (−2.03)*	−0.00003 (−0.001)	0.0711 (0.61)	−0.0072 (−0.30)	0 6614	0.4374	0.3474	4.86	2 27	0 4025
ΔTop 5% (−0.06)	0 0217 (0.22)	−0.1782 (−0.95)	0 0104 (0.28)	0.0256 (0.17)	0 0126 (0.40)	03172	0.1006	−0 0433	0 70	2 93	0 5273
ΔGini Ratio (−0 0005)	0 0008 (1.12)	−0.0030 (−2.09)*	−0 0006 (−1.99)*	0.0006 (0.51)	−0.0003 (−1 23)	0.7648	0 5849	0 5185	8 81	2 16	0 0040

of the regression coefficients are likely to have been underestimated in some of the above equations.

For the above reason, several regression equations were recalculated with the variables in first order differences, and the results are summarized in Table 2. The results are very similar to those of Table 1, with regard to the signs of the regression coefficients, but there are some changes in the statistical significance of the coefficients. However, the regression results in first order differences confirm the previous findings that the rate of inflation tends to increase the relative income share of the lowest 5th group. Previously, in Table 1, the rate of inflation was not significant for the Gini ratio, but we note that in Table 2, the rate of inflation has a negative sign and is significant. In short, an overall examination of the results of Tables 1 and 2 suggests that inflation tends to increase the relative income share of the lowest 5th group and tends to reduce income inequality. However, the effect of inflation on the top 5% group is now inconclusive. The effect of inflation on the fourth 5th group is negative, significant, and consistent in the two tables.

V. Recession, Trend, and Personal Income Distribution

In the previous section, we have examined the empirical significance of inflation, the rate of unemployment, and other variables. However, the regression analysis measures the new effect of one variable, with other variables held constant. In order to observe the "total" effect of recession on the relative income share and income inequality, the time series data are plotted in Figures 1-5. Also, to permit more accurate observations of numerical changes in the relative income shares and income inequality, measures occuring between one year before the trough and the trough, and between the trough and one year afterwards, were calculated. The following observations result:

First, between one year before trough and the trough year, the lowest 5th income group lost their relative income share 5 times out of 6 recessions during 1948~76; the second 5th group lost every time; the middle 5th group lost 4 times, the fourth 5th group lost 1 time, and the highest 5th group never lost. But it is interesting to note that the top 5% lost just

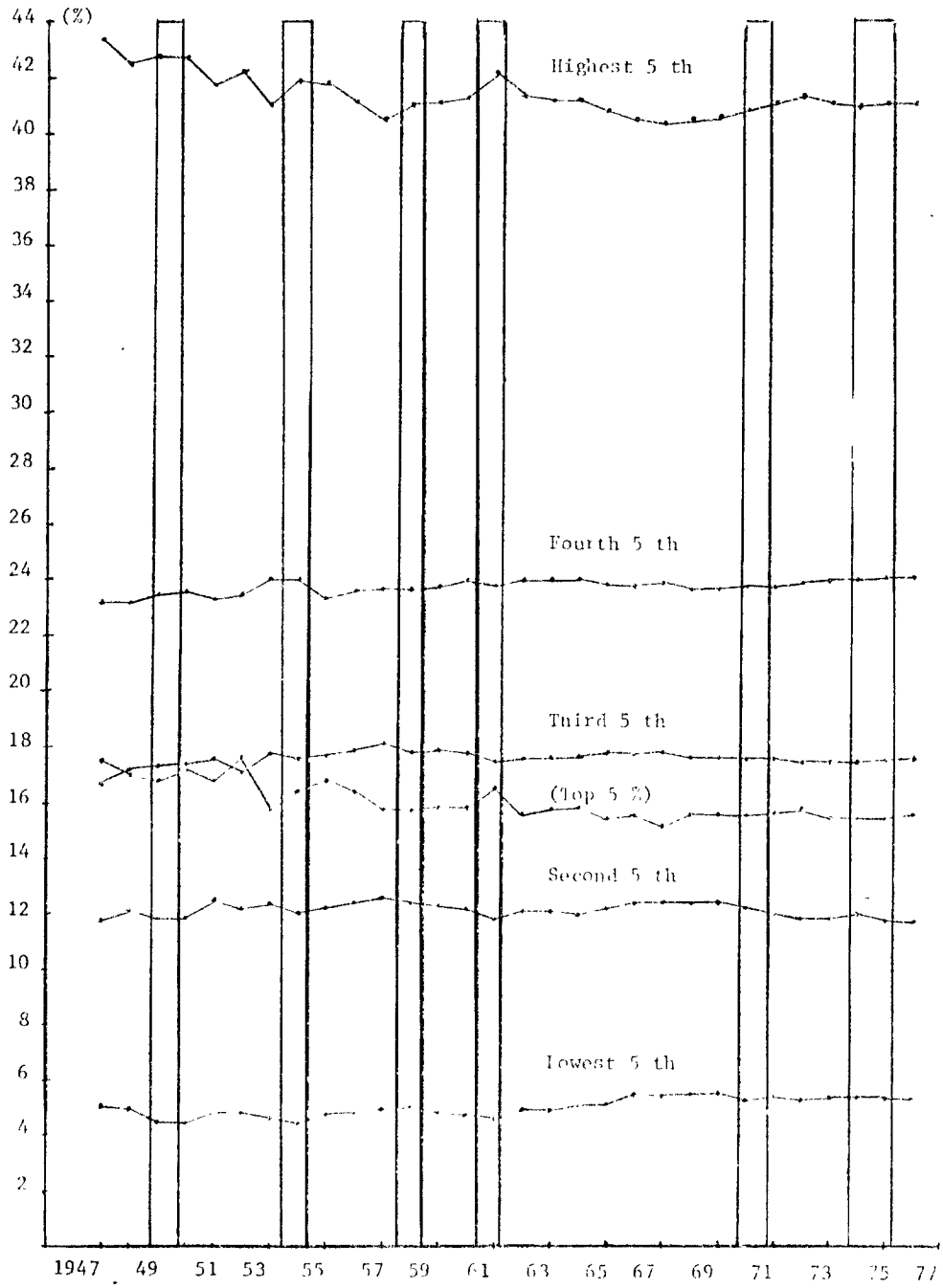

Fig. 1. Percentage Shares of Income by Quantiles (All Families)

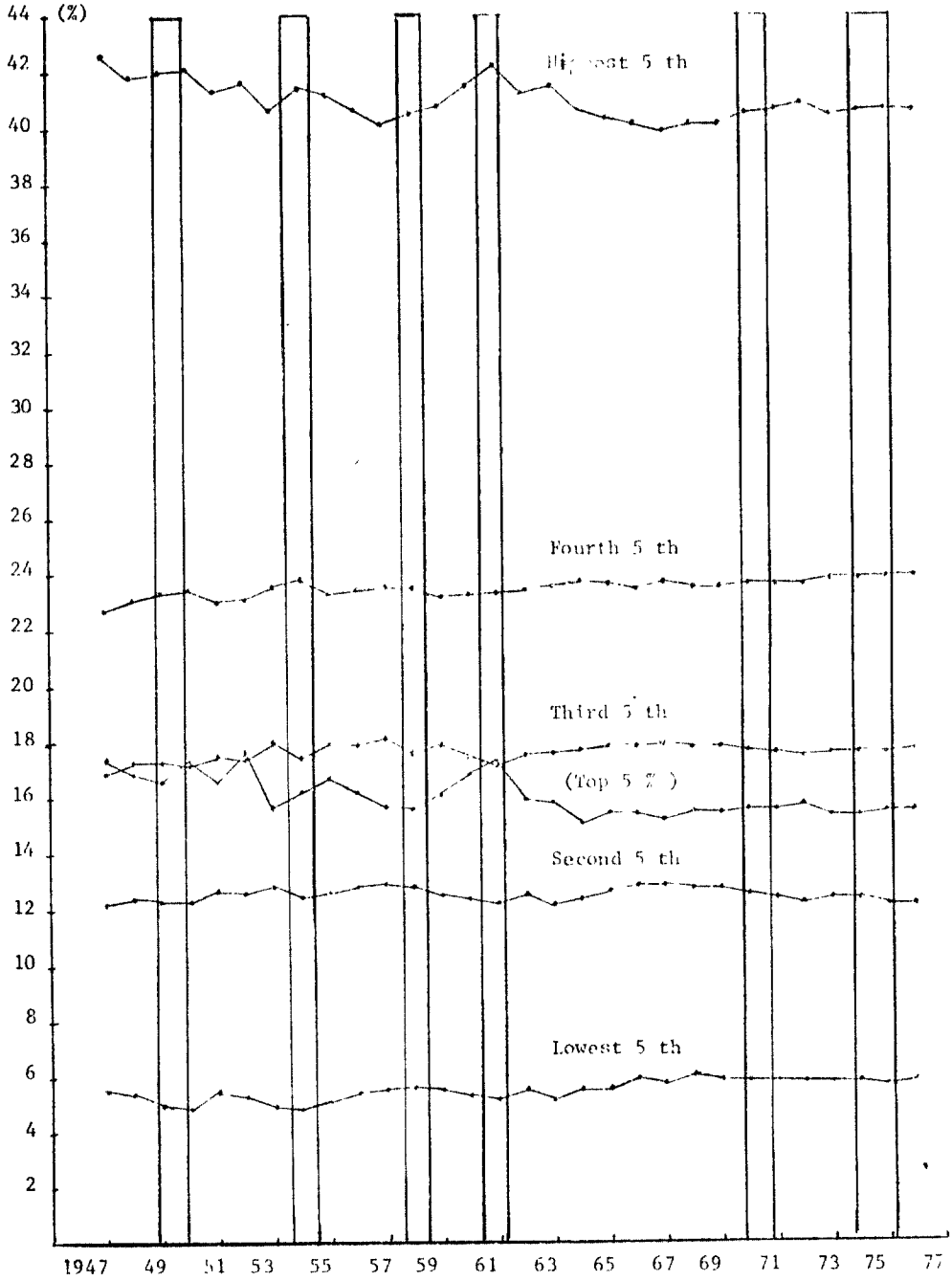

Fig. 2. Percentage Shares of Income by Quantiles (White Families)

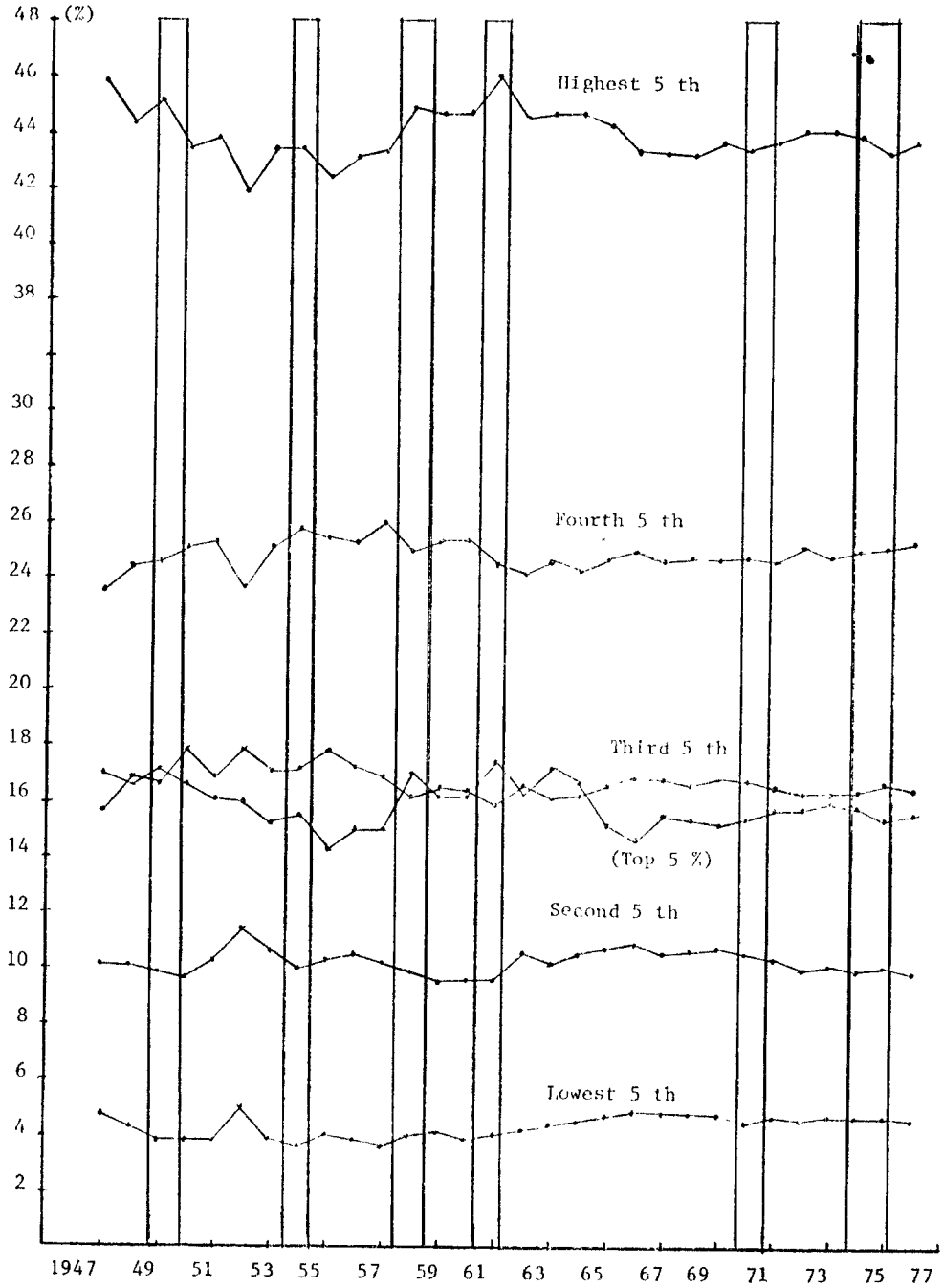

Fig. 3. Percentage Shares of Income by Quantiles (Black and Other Families)

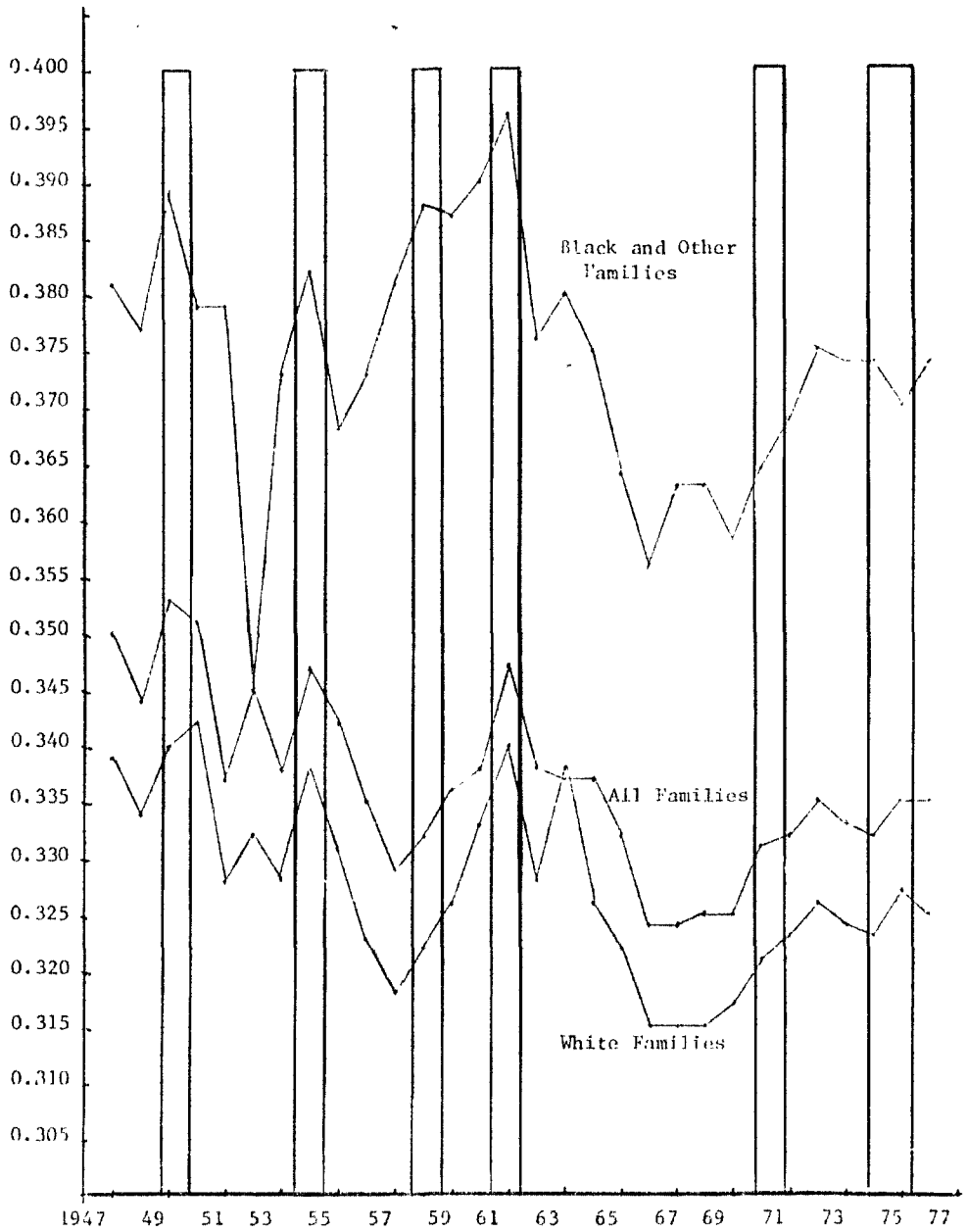

Fig. 4. The Gini Ratio in the U.S. (1947~76)

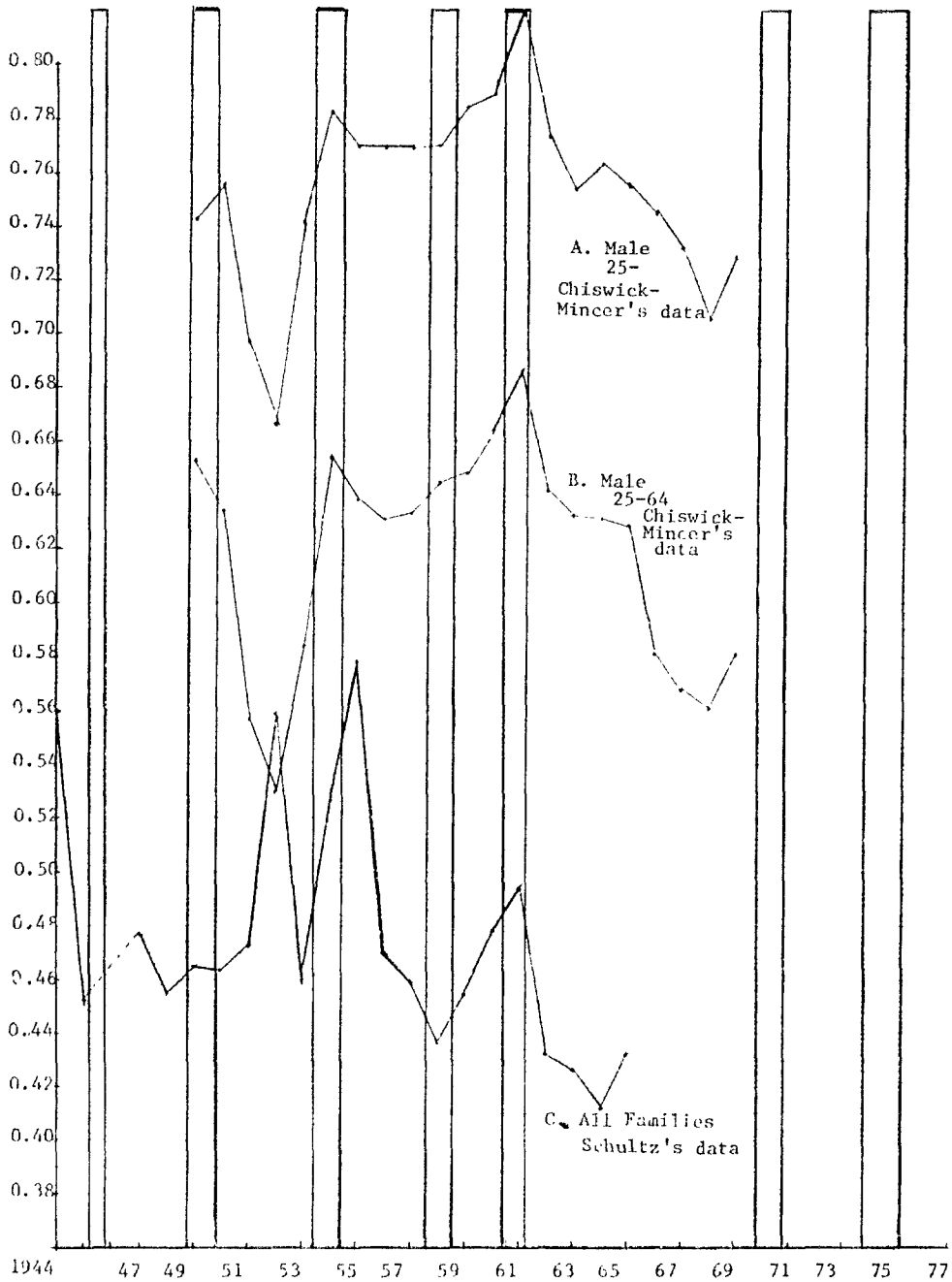

Fig. 5. Variance of the Logarithmic Income: Var(ln*Y*)

once. In short, it is apparent that the first three low income quantiles tend to lose during recession years. When the relative income shares of the trough year and one year after the trough were compared, the following results were obtained. The lowest 5th group gained 5 times out of 6 recoveries, the second 5th group gained 4 times, the third 5th group gained every time, the fourth 5th group gained 5 times, and the highest 5th group lost 3 times during 6 recoveries. In effect, the three low income groups tended to lose during recession years, and tended to gain during recovery years. However, it is apparent that the speed of recovery and the speed of loss are not precisely symmetrical.

Second, the same type of examination was carried out for the summary income inequality measures. The Gini ratio increased 6 times during 6 recessions. The variance of the logarithmic income likewise increased 4 times out of 4 recessions of observation. During 6 recoveries, the Gini ratio decreased 3 times. During 4 recessions of observation, the variance of the logarithmic income decreased 3 times. These results are consistent with the movements of the relative income shares. That is, although again the speed of recovery and that of loss are not precisely symmetrical, the above results confirm that income inequality increases during recession years and improves during recovery years.

Finally, a brief observation may be made about the long run trend of the relative income shares and income inequality. As may be seen in Figures 1-5, the relative income shares of the lowest, the second, and the third 5ths remained almost stable. Only slight decreasing tendencies are shown in the highest 5th, and the top 5% groups. The losses were apparently reflected in the slight gains in the fourth 5th group. However, particularly since the late 1960's, the relative income shares have been quite stable.

To be a bit more specific, during 1947～76, the lowest 5th group gained very slightly by 0.3 percentage points, from 5.1% to 5.4%. The second 5th group remained constant at 11.8%. The third and the fourth 5th groups both gained by 0.9%, from 16.7% to 17.6%, and from 23.2% to 24.1%. Only the highest 5th group lost by 2.2%, from 43.3% to 41.1%. The top 5% group lost by 1.9%, from 17.5% to 15.6%. In other words, the loss of 2.2 percentage points by the highest 5th group was shared largely

by the third and fourth 5th middle income groups. The lowest 5th group gained only 0.3, and the second 5th group did not obtain any gain in the relative income share. The over-all income inequality changed very slightly during the same 30 year period, 1947～76. The summary measure of income inequality i.e., the Gini ratio, decreased only by 0.015, from 0.350 to 0.335. This is a decrease of 4.3% over the 30 years, or 0.14% per year. The Gini ratio for the white families decreased from 0.339 to 0.325, by 0.014 or by 4.1%. The Gini ratio for the black and other racial minority families decreased from 0.381 to 0.374, by 0.007 or by 1.8%. This is a decrease of 0.06% per year.[11] It should be noted that income inequality for black and other families now is far greater than it was for white families 30 years ago.

VI. Summary and Conclusions

In the above sections, we have seen that the relative income shares of the lowest groups have remained virtually the same without significant trend, except for cyclical fluctuations. In order to test the empirical significance of inflation, the rate of unemployment, and other relevant variables, we have calculated a number of regression equations. The statistical significance of the variables varied with the model and the period of observation. However, the following tentative conclusions may be made.

(1) The lowest 5th group tends to gain and the fourth 5th tends to lose during inflation, and the overall income inequality tends to decrease. The gain by the lowest 5th group may be partially explained by the hypothesis that during the period of inflation the demand for labor rises, the rate of unemployment decreases, and the labor participation rate increases among the low income groups. As a result, their relative and absolute income shares increase.

(2) Other significant variables were the rate of unemployment and the

(11) Browning [11] and Paglin [25] maintain that income inequality has significantly decreased. Browning adjusts the relative imcome share by taking into consideration the following factors: Money income, under reporting, benefits in-kind, education, capital gains, potential additional earnings, income and payroll taxes(—). Paglin takes into consideration the age distribution of families.

percent of employed workers. As the rate of unemployment increases, income inequality increases, and as the percent of employed workers increases, income inequality decreases. This may be because the wage gap is smaller among the employed workers than between employed workers and self-employed workers.

(3) Third, as to the policy implications, in light of these findings we would not advocate pro-inflation policies to increase income equality. The increases in the relative income share of the lowest 5th group may be a result of desperate struggle by the low income group to sustain a subsistence level of real income by increasing labor force participation during a period of rapidly rising prices. A more positive approach is to reduce the rate of unemployment without inflation. And that is a current economic problem which has not yet been solved. Also, the statistical significance of the percent of employed workers suggests that any policies to minimize the wage gap among workers within or between industries may be valid and important ways of reducing income inequality.[12]

(12) For an interesting model concerning an affirmative action program, see Bell [8]. Bell argues that a firm hires black workers as long as the difference between the marginal cost of moving up the white supply curve is less than the wage rate differential between black and white workers. Otherwise, Bell argues, the firm will suspend the affirmative action program on the grounds that qualified applicants are no longer available and hire white workers.

Appendix Note

In addition to the relative income share method, the Gini ratio, the Paglin's Gini Ratio, the mean income ratio, and the variance of the logarithmic income, there exist the following methods of measuring income inequality:

(1) Pareto's α is given by

$$N_y = A/Y^{-\alpha}$$

or $$ln\ N_y = ln\ A - \alpha\ ln\ Y.$$

(2) Bowman's α is given by

$$N_y = A - \alpha\ ln\ Y$$

where N_y = the number or the percent of population whose income is equal to and greater than a given level of income Y.

Y = the given level of income.

(3) The relative mean deviation is defined as

$$\sum\left(\frac{Y_i - \bar{Y}}{\bar{Y}} \Delta N_i\right)$$

where Y_i = the mean income of each group

$\bar{Y}$ = the grand mean income of all groups

ΔN_i = the percent of population in ith group.

(4) Dalton's ratio is given by

$$\frac{ln\ Y_a}{ln\ Y_g} \quad \text{or} \quad \frac{c - \frac{1}{Y_a}}{c - \frac{1}{Y_h}}$$

where Y_a = arithmetic mean of income groups

Y_g = the geometric mean of income groups

Y_h = the harmonic mean of income groups

c = a constant.

(5) Atkinson's ratio is given by

$$I = 1 - \left[\sum_{i=1}\left(\frac{Y_i}{\bar{Y}}\right)^{1-\epsilon} \Delta N_i\right]^{1/(1-\epsilon)} \qquad \text{when } \epsilon > 0 \text{ and} \neq 1.$$

and $$ln\ I = 1 - \sum_{i=1} ln(Y_i/\bar{Y})\Delta N_i \qquad \text{when } \epsilon = 1.0$$

where Y_i = the mean income of ith group

$\bar{Y}$ = the mean income of all groups

ΔN_i = the percent of population in ith group

ϵ = the distribution parameter determined by the social welfare function

$\epsilon > 0$. e.g., 0.5, 1.0, 1.5, 2.0, ...

Appendix Table 1. Measures of Income Distribution

The Gini Ratio (columns 1~10) and the Variance of Logarithmic Income (columns 11~13)

	(1) All Families	(2) White Families	(3) Black and Other Fami.	(4) All Families	(5) White Fami.	(6) Black and Other Families
1944						
45						
46						
47	0.350	0.339	0.381	0.378	0.363	0.406
48	0.344	0.334	0.377	0.369	0.361	0.406
49	0.353	0.340	0.389	0.379	0.367	0.415
50	0.351	0.342	0.379	0.375	0.372	0.402
51	0.337	0.328	0.379	0.361	0.352	0.405
52	0.345	0.332	0.345	0.374	0.359	0.365
53	0.338	0.328	0.373	0.360	0.353	0.393
54	0.347	0.338	0.382	0.373	0.359	0.402
55	0.342	0.331	0.368	0.366	0.358	0.388
56	0.335	0.323	0.373	0.355	0.347	0.396
57	0.329	0.318	0.381	0.351	0.345	0.405
58	0.332	0.322	0.388	0.354	0.340	0.417
59	0.336	0.326	0.387	0.366	0.349	0.414
60	0.338	0.333	0.390	0.369	0.357	0.410
61	0.347	0.340	0.396	0.376	0.364	0.414
62	0.338	0.328	0.376	0.365	0.350	0.403
63	0.337	0.338	0.380	0.360	0.348	0.403
64	0.337	0.326	0.375	0.352	0.349	0.399
65	0.332	0.322	0.364			
66	0.324	0.315	0.356			
67	0.324	0.315	0.363			
68	0.325	0.315	0.363			
69	0.325	0.317	0.358			
70	0.331	0.321	0.367			
71	0.332	0.323	0.369			
72	0.335	0.326	0.375			
73	0.333	0.324	0.374			
74	0.332	0.323	0.374			
75	0.335	0.327	0.370			
76	0.335	0.325	0.374			
77						
78						

Appendix Table 1 (Continued)

	(7) Unrelated individuals	(8) Male	(9) Female	(10) Fam. and unre. ind.	(11) Var($ln\ Y$)	(12) Var($ln\ Y$) 25-male	(13) Var($ln\ Y$) 25-64 male
1944				0.4102	0.5598		
45				0.3773	0 4519		
46				(0.3800)	(0.4647)		
47	0.568	0.514	0.522	0.3827	0.4774		
48	0.479	0.479	0.477	0.3773	0.4551		
49	0.476	0.463	0.466	0.3852	0.4652	0.7422	0.6533
50	0.483	0.451	0.496	0.3831	0.4639	0.7552	0.6341
51	0.477	0.442	0.473	0.3681	0.4733	0.6968	0.5570
52	0.479	0.439	0.485	0.3726	0.5586	0.6657	0.5295
53	0.518	0.489	0.510	0.3648	0.4588	0.7411	0.5844
54	0.506	0.501	0.491	0.3803	0.5272	0.7821	0.6545
55	0.498	0.470	0.517	0.3752	0.5793	0.7699	0.6387
56	0.487	0.461	0.484	0.3635	0.4697	0.7691	0.6312
57	0.490	0.470	0.480	0.3588	0.4597	0.7694	0.6334
58	0.502	0.496	0.490	0.3598	0.4372	0.7699	0.6447
59	0.512	0.496	0.514	0.3646	0.4552	0.7842	0.6483
60	0.491	0.469	0.479	0.3719	0.4781	0.7893	0.6635
61	0.507	0.498	0.479	0.3805	0.4938	0.8219	0.6858
62	0.496	0.483	0.482	0.3642	0.4302	0.7626	0.6413
63	0.506	0.495	0.492	0.3651	0.4264	0.7531	0.6318
64	0.508	0.485	0.505	0.3607	0.4120	0.7627	0.6307
65				0.3658	0.4316	0.7551	0.6282
66						0.7450	0.5808
67						0.7319	0.5675
68						0.7048	0.5609
69						0.7294	0.5813
70							
71							
72							
73							
74							
75							
76							
77							
78							

Note : Columns (4)～(6) are from U S. Bureau of the Census, *Trends in the Income of Families and Persons in the United States*, 1947～1964, Technical Paper 17, 1967, pp. 170-175.
Columns (1)～(3) were calculated by the ordinary (linear) method of Gini ratio calculation, as explained in the above publication, pp. 35-36.

The basic data were taken from the above publication for 1947~64, and *Historical Statistics of the United States, Colonial Times to* 1970, Part 1, 1975, p. 293, for 1965~70, and *Statistical Abstract of the United States*, 1977 (98th ed.), p. 443, and other issues for 1971~76.

Source : Columns (7)~(9), from the U.S. Bureau of the Census, Technical Paper, 17, op. cit., pp. 176-181.

Columns (10)~(11), from Schultz, T.P., "Secular Trends and Cyclical Behavior of Income Distribution in the United States: 1944~65", in Soltow, L., ed., *Six Papaers on the Size Distribution of Income and Wealth*, Studies in Income and Wealth, Vol 33, NBER, 1969, pp. 75-106.

Columns (12)~(13), from Chiswick, B.R., and Mincer, J., "Time-Series Changes in Personal Income Inequality in the United States from 1949, with Projections to 1935", *Journal of Political Economy*, May/June 1972, Supplement, pp. S35-S66.

Appendix Table 2. The Relative Income Shares by Quantiles (All Families) (%)

	Lowest 5th	Second 5th	Third 5th	Fourth 5th	Highest 5th	Top 5%
1944						
45						
46						
47	5.1	11.8	16.7	23.2	43.3	17.5
48	5.0	12.1	17.2	23.2	42.5	17.1
49	4.5	11.9	17.3	23.5	42.8	16.9
50	4.5	11.9	17.4	23.6	42.7	17.3
51	4.9	12.5	17.6	23.3	41.8	16.9
52	4.9	12.2	17.1	23.5	42.2	17.7
53	4.7	12.4	17.8	24.0	41.0	15.8
54	4.5	12.0	17.6	24.0	41.9	16.4
55	4.8	12.2	17.7	23.4	41.8	16.8
56	4.9	12.4	17.9	23.6	41.1	16.4
57	5.0	12.6	18.1	23.7	40.5	15.8
58	5.1	12.4	17.8	23.7	41.0	15.8
59	4.9	12.3	17.9	23.8	41.1	15.9
60	4.8	12.2	17.8	24.0	41.3	15.9
61	4.7	11.9	17.5	23.8	42.2	16.6
62	5.0	12.1	17.6	24.0	41.3	15.7
63	5.0	12.1	17.7	24.0	41.2	15.8
64	5.1	12.0	17.7	24.0	41.2	15.9
65	5.2	12.2	17.8	23.9	40.9	15.5
66	5.6	12.4	17.8	23.8	40.5	15.6
67	5.5	12.4	17.9	23 9	40.4	15.2
68	5.6	12.4	17.7	23.7	40.5	15.6
69	5.6	12.4	17.7	23.7	40.6	15.6
70	5.4	12.2	17.6	23.8	40.9	15.6

71	5.5	12.0	17.6	23.8	41.1	15 7
72	5.4	11.9	17.5	23.9	41.4	15.9
73	5.5	11.9	17.5	24 0	41.1	15.5
74	5.5	12.0	17.5	24.0	41.0	15.5
75	5.4	11.8	17 6	24.1	41.1	15.5
76	5.4	11.8	17.6	24.1	41.1	15.6
77						

Source : The same sources listed for Appendix Table 1, for columns (4)～(6).

Appendix Table 3. The Relative Income Shares by Quantiles (White Families) (%)

	Lowest 5th	Second 5th	Third 5th	Fourth 5th	Highest 5th	Top 5%
1944						
45						
46						
47	5.5	12 2	16.9	22.8	42.6	17 4
48	5.4	12.4	17.3	23 1	41.9	16.9
49	5 0	12.3	17.3	23.4	42.0	16.6
50	4 9	12.3	17 2	23.5	42.1	17 3
51	5.5	12.7	17.5	23.0	41 3	16 6
52	5.3	12.6	17.4	23.1	41.6	17.6
53	5.0	12.8	18.0	23.6	40.6	15 7
54	4.9	12 4	17.5	23.8	41 4	16.2
55	5.1	12.6	17.9	23.3	41.1	16.7
56	5 4	12.8	17.9	23.4	40 6	16.2
57	5.5	12.9	18.1	23.5	40.1	15.7
58	5.6	12.8	17.6	23.5	40 5	15.6
59	5.5	12 5	17.9	23.2	40 8	16.1
60	5 3	12.4	17.5	23 3	41.5	16.8
61	5.2	12.2	17.1	23.3	42.2	17.3
62	5 5	12.5	17 5	23 4	41.2	15.9
63	5.1	12.1	17.6	23 6	41.6	15.8
64	5.6	12.3	17.7	23.8	40.6	15.0
65	5 6	12.6	17.8	23.7	40.3	15.4
66	5.9	12.8	17.8	23.5	40.1	15.4
67	5.8	12.8	17.9	23.7	39.9	15.1
68	6.0	12.7	17.8	23.5	40.1	15.5
69	5.9	12.7	17.8	23.5	40.1	15 4
70	5.8	12.5	17.7	23 6	40.5	15.5
71	5.8	12.4	17.6	23.6	40.6	15.5
72	5.8	12.2	17.5	23.6	40.9	15.7
73	5.8	12.3	17.6	23.8	40.5	15.3

74	5.8	12.3	17.6	23.8	40.6	15.3
75	5.7	12.1	17.6	23.9	40.7	15.4
76	5.8	12.1	17.7	23.9	40.6	15.4
77						
78						

Appendix Table 4. The Relative Income Shares by Quantiles (Black and Other Families) (%)

	Lowest 5th	Second 5th	Third 5th	Fourth 5th	Highest 5th	Top 5%
1944						
45						
46						
47	4.8	10.2	15.7	23.6	45.8	17.0
48	4.3	10.1	16.9	24.4	44.3	16.6
49	3.8	9.9	16.6	24.6	45.1	17.1
50	3.8	9.7	17.9	25.1	43.4	16.6
51	3.8	10.3	16.9	25.3	43.8	16.1
52	5.0	11.4	17.9	23.7	41.9	16.0
53	3.9	10.7	17.0	25.1	43.4	15.2
54	3.6	10.0	17.2	25.8	43.4	15.5
55	4.0	10.3	17.8	25.5	42.4	14.3
56	3.9	10.5	17.2	25.3	43.1	15.0
57	3.6	10.2	16.9	26.0	43.3	15.0
58	4.0	9.9	16.2	25.0	44.9	17.0
59	4.1	9.5	16.5	25.3	44.7	16.2
60	3.9	9.6	16 4	25.4	44.7	16.2
61	4.0	9.6	15.9	24.5	46.0	17.4
62	4.2	10.6	16.6	25.2	44.5	16.3
63	4.4	10.2	16.1	24.6	44.7	17.2
64	4.5	10.5	16.2	24.3	44.6	16.7
65	4.7	10.8	16.6	24.7	43.2	15.1
66	4.9	10.9	16.9	25.0	42.3	14.6
67	4.8	10.6	16.8	24.6	43.2	15.5
68	4.8	10.7	16.6	24.8	43.2	15.4
69	4.8	10 9	16.9	24.7	42.7	15.2
70	4.5	10.6	16.8	24.8	43.4	15.4
71	4.7	10.4	16.5	24.7	43.7	15.7
72	4.6	10.0	16.3	25.1	44.1	15.8
73	4.7	10.1	16.3	24.8	44.1	16.0
74	4.7	10.0	16.4	25.0	43.9	15.9
75	4.7	10.1	16.7	25.1	43.3	15.4
76	4.6	9.9	16.5	25.3	43.7	15.6
77						
78						

Appendix Table 5. Percentage Income Shares during Recession (One Year Prior to Trough) (All Families)

	Lowest 5th	Second 5th	Third 5th	Fourth 5th	Highest 5th	Top 5%	U (%)	$\Delta P/P$ (%)
1948	5.0	12.1	17.2	23.2	42.5	17.1	3.8	7.8
49*	4.5	11.9	17.3	23.5	42.8	16.9	5.9	−1.0
	−0.5	−0.2	0.1	0.3	0.3	−0.2	2.1	−8.8
1953	4.7	12.4	17.8	24.0	41.0	15.8	2.9	0.8
54*	4.5	12.0	17.6	24.0	41.9	16.4	5.5	0.5
	−0.2	−0.4	−0.2	0.0	0.9	0.6	2.6	−0.3
1957	5.0	12.6	18.1	23.7	40.5	15.8	4 3	3.6
58*	5 1	12.4	17.8	23 7	41 0	15.8	6.8	2.7
	0.1	−0.2	−0.3	0.0	0.5	0.0	2 5	−0.9
1960	4.8	12.2	17.8	24.0	41.3	15.9	5.5	1 6
61*	4.7	11.9	17.5	23.8	42.2	16.6	6.7	1.0
	−0.1	−0 3	−0.3	−0.2	0 9	0.7	1.2	−0.6
1969	5.6	12.4	17.7	23.7	40.6	15.6	3.5	5.4
70*	5.4	12.2	17.6	23.8	40.9	15.6	4.9	5.9
	−0.2	−0.2	−0.1	0.1	0.3	0.0	1.4	0.5
1974	5.5	12.0	17.5	24.0	41 0	15.5	5.6	11.0
75*	5.4	11.8	17.6	24.1	41.1	15.5	8.5	9.1
	−0.1	−0.2	0.1	0.1	0.1	0.0	2.9	−1.9

Note : *indicates the trough year. Figures may not add up to 100.0 due to the rounding error. U=the rate of unemployment.

Appendix Table 6 Percentage Income Shares during Recovery (One Year after Trough) (All Families)

	Lowest 5th	Second 5th	Third 5th	Fourth 5th	Highest 5th	Top 5%	U (%)	ΔP/P (%)
1949*	4.5	11 9	17 3	23.5	42.8	16 9	5.9	−1.0
50	4.5	11.9	17.4	23.6	42.7	17.3	5 3	1.0
	0.0	0.0	0.1	0 1	−0.1	0.4	−0.6	2.0
1954*	4.5	12.0	17.6	24 0	41.9	16.4	5.5	0.5
55	4.8	12.2	17 7	23.4	41.8	16.8	4.4	−0.4
	0 3	0.2	0.1	−0.6	−0.1	−0.4	−1.1	−0.9
1958*	5.1	12.4	17.8	23.7	41.0	15.8	6.8	2.7
59	4.9	12.3	17.9	23.8	41.1	15.9	5.9	0.9
	−0 2	−0.1	0.1	0.1	0.1	0 1	−1.3	−1.8
1961*	4.7	11.9	17.5	23 8	42.2	16.6	6 7	1.0
62	5.0	12.1	17 6	24.0	41.3	15.7	5.5	1.1
	0.3	0.2	0.1	0 2	−0.9	−0.9	−1.2	0 1
1970*	5.4	12 2	17.6	23 8	40.9	15 6	4.9	5.9
71	5.5	12.0	17.6	23.8	41.1	15.7	5.9	4.3
	0.1	−0.2	0.0	0.0	0.2	0.1	1.0	−1.6
1975*	5.4	11.8	17.6	24 1	41.1	15.5	8.5	9.1
76	5.4	11.8	17.6	24.1	41.1	15.6	7.7	5.8
	0 0	0.0	0.0	0.0	0.0	0.1	−0 8	−3 3

Appendix Table 7. The Variance of the Logarithmic Income during Recession (One Year prior to Trough)

	Chiswick-Mincer (1972)			Schultz (1969)				
	Male 25~64	Male 25~	Male 35~44	All families	White male	Black male	U (%)	ΔP/P (%)
1944				0.5598			1.2	1.7
45*				0.4519			1.9	2.3
				−0.1079			0.7	0.6
1948				0.4551			3.8	7.8
49*	0.6533	0.7422	0.6229	0.4652	0.697	0.701	5.9	−1.0
				0.0101			2.1	−8.8
1953	0.5844	0.7411	0.5231	0.4588	0.665	0.530	2.9	0.8
54*	0.6545	0.7821	0.5949	0.5272	0.647	0.746	5.5	0.5
	0.0701	0.041	0.0718	0.0684	−0.018	0.216	2.6	−0.3
1957	0.6334	0.7694	0.5531	0.4597	0.655	0.520	4.3	3.6
58*	0.6447	0.7699	0.5311	0.4372	0.606	0.712	6.8	−2.7
	0.0113	0.0005	−0.0220	−0 0225	0.049	0.192	2.5	−0.9
1960	0.6635	0.7893	0.5886	0.4781	0.698	0.579	5.5	1.6
61*	0.6858	0.8216	0.5993	0.4938	0.674	0.684	6.7	1.0
	0 0223	0.0326	0.0107	0 0157	0.024	0.105	1.2	−0.6
1969	0.5813	0 7294	0.5231				3.5	5.4
70*							4.9	5.9
							1.4	0.5
1974							5.6	11.0
75*							8.5	9.1
							2.9	−1.9

U=the rate of unemployment (%)

Note : *indicates the trough year.

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Appendix Table 8. The Variance of the Logarithmic Income during Recovery (One Year after Trough)

	Chiswick-Mincer (1972)			Schultz (1969)				
	Male 25~64	Male 25~	Male 35~44	All families	White male	Black male	U (%)	ΔP/P (%)
1945*				0.4519			1.9	2.3
46							3.9	8.5
							2.0	6.2
1949*	0.6533	0.7422	0.6229	0.4652	0.679	0.701	5.9	−1.0
50	0.6341	0.7552	0.5477	0.4639	0.704	0.523	5.3	1.0
	−0.0192	0.0130	−0.0752	−0.0013	0.007	−0.178	−0.6	2.0

1954*	0.6545	0.7821	0.5949	0.5272	0.647	0.746	5.5	0.5
55	0.6387	0.7699	0.5212	0.5793	0.803	0.510	4.4	−0.4
	−0.0158	−0.0122	−0.0737	0.0521	0.156	−0.236	−1.1	−0.9
1958*	0.6447	0.7699	0.5311	0.4372	0.606	0.712	6.8	2.7
59	0.6483	0.7842	0.5164	0.4552	0.669	0.710	5.5	0.8
	0.0036	0.0143	−0.0147	0.0180	0.063	−0.002	−1.3	−1.9
1961*	0.6858	0.8219	0.5993	0 4938	0.674	0.684	6.7	1.0
62	0.6413	0.7626	0.5317	0.4302	0.647	0.516	5.5	1.1
	−0.0445	−0.0593	−0 0676	−0.0636	−0.027	−0.168	−1.2	0.1
1970*							4.9	5.9
71							5.9	4.3
							1.0	−1.6
1975*							8.5	9.1
76							7.6	5.8
							−0.8	−3.3

Appendix Table 9. The Gini Ratio during Recession (One Year prior to Trough)

	(1) All Families	(2) White Families	(3) Black and Other Families	(4) U(%) All	(5) U(%) White	(6) U(%) Black and Other
1948	0.344	0.334	0.337	3.8	3.5	5.9
49*	0.353	0.340	0.389	5.9	5.6	8.9
	0.009	0.006	0.012	2.1	2.1	3.0
1953	0.338	0.328	0.373	2.9	2.7	4.5
54*	0.347	0.338	0.382	5.5	5.0	9.9
	0.009	0.010	0.009	2.6	2.3	5.4
1957	0.329	0.318	0.381	4.3	3.8	7.9
58*	0.332	0.322	0.388	4.8	6 1	12.6
	0 003	0.004	0.007	0.5	2.3	4.7
1960	0.338	0.333	0.390	5.5	4 9	10 2
61*	0.347	0.340	0.396	6.7	6.0	12.4
	0.032	0.007	0.006	1.2	1.1	2.2
1969	0.325	0.317	0.358	3.5	3.1	6.4
70*	0.331	0.321	0.367	4.9	4.5	8.2
	0.006	0.004	0.009	1.4	0.6	1.8
1974	0.332	0.323	0.374	5.6	5.0	9.9
75*	0.335	0.327	0.370	8.5	7.8	13.9
	0.003	0.004	−0.004	2.9	2.8	4.0

Appendix Table 10. The Gini Ratio during Recovery (One Year after Recovery)

	(1) All Families	(2) White Families	(3) Black and Other Families	(4) U(%) All	(5) U(%) White	(6) U(%) Black and Other
1949*	0.353	0.340	0.389	5 9	5.6	8.9
50	0.351	0.342	0.379	5.3	4.9	9.0
	−0.002	0.002	−0 010	−0.6	−0.7	0.1
1954*	0.347	0.338	0.382	5.5	5.0	9.9
55	0.342	0.331	0.368	4.4	3.9	8.7
	−0.005	−0.007	−0.014	−1.1	−1.1	−1.2

1958*	0.332	0.322	0.388	6.8	6.1	12.6
59	0.336	0.326	0.387	5.5	4.8	10.7
	0.004	0.004	−0.001	1.3	−1.3	−1.9
1961*	0.347	0.340	0.396	6.7	6.0	12.4
62	0.338	0.328	0.376	5.5	4.9	10.0
	−0.009	−0.012	−0.020	−1.2	−1.1	−1.5
1970*	0.331	0.321	0.367	4.9	4.5	8.2
71	0.332	0.323	0.369	5.9	5.4	9.9
	0.001	0.002	0.002	1.0	0.9	1.7
1975*	0.332	0.327	0.370	8.5	7.8	13.9
76	0.335	0.325	0.374	7.7	7.0	13.1
	0.003	−0.002	0.004	−0.8	−0.8	−0.8

Appendix Table 11. Economic Data

	(1) N/E (%)	(2) ΔP/P (%)	(3) U (%)	(4) ΔQ/Q (%)
1944	77.6	1.7	1.2	7.5
45	76.5	2.3	1.9	−1.4
46	75.4	8.5	3.9	−14.7
47	75.9	14.4	3.9	−1.8
48	76.9	7.8	3.8	4 1
49	75.9	−1.0	5.9	0.6
50	76.8	1.0	5.3	8.7
51	79.8	7.9	3.3	8.1
52	81.0	2.2	3.0	3.8
53	82.1	0.8	2.9	3.9
54	81 6	0.5	5.5	−1.3
55	81.5	−0.4	4.4	6.7
56	82.1	1.5	4.1	2.1
57	82.6	3.6	4.3	1.8
58	81.5	2.7	6.8	−0.2
59	82.5	0.8	5.5	6.0
60	82.5	1.6	5.5	2.3
61	82.2	1.0	6.7	2.5
62	82.3	1.1	5.5	5.8
63	83.7	1.2	5.7	4.0
64	84.2	1.3	5.2	5.3
65	85.5	1.7	4.5	5.9
66	87.7	2.9	3.8	5.9
67	88.6	2.9	3.8	2.7
68	89.5	4.2	3.6	4.4
69	90.4	5.4	3.5	2.6
70	90.2	5.9	4.9	−0.3
71	90.0	4.3	5.9	3.0
72	90.2	3.3	5.6	5.7
73	91.1	6.2	4.9	5.5
74	91.2	11.0	5.6	−1.4
75	90.9	9.1	8.5	−1.3
76	90.8	5.8	7.7	6.0
77	90.7	6.5	7.0	4.9

N/E=total employed workers/workers
ΔP/P=the rate of inflation in consumer prices
U=the rate of unemployment
ΔQ/Q=the rate of real GNP growth

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