INCOME DISTRIBUTION ISSUES
VIEWED IN A LIFETIME INCOME PERSPECTIVE*

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In the June 1977 issue of the *American Economic Review* extraordinary attention was given to the statistical problem of measuring the effect on inequality in current income arising from differences associated with age. The method adopted by Paglin was severely criticized although everyone recognized the value of Paglin's unusual, if not original, emphasis on the importance of the underlying issue.

This paper is not primarily concerned with the statistical problem of correcting data on current income distributions for income-age differences. It is concerned mainly with the lifetime income perspective itself—with ways of viewing the long-term path of persons and of ways of viewing inequalities in that path as they develop within and among different generations.

The paper discusses issues of measurement on a birth-cohort or longitudinal basis, recent trends for selected cohorts, intra- and inter-cohort variances in lifetime income, and various policy issues, for example, the equity of the U.S. Social Security System viewed on a lifetime dimension.

INTRODUCTION

Many issues of concern about income distribution are being increasingly viewed in a lifetime context, partly because a lifetime context refers to the long run, total, or permanent, rather than transitory, economic welfare of a person. This isn't to downgrade the importance for welfare policy of transitory conditions such as temporary loss of job or disability, but more to recognize that many of the concerns about improving low-income situations are of a long run nature involving the need to bring about a higher level of lifetime income.

A distinct age-income relationship is a pervasive phenomenon, having existed for some time in many countries, reflecting the common pattern of change in a person's income: rising in the younger years and levelling off and declining in the later years. Differences in the level and time shape of this path are likely to become useful indicators of economic well-being. Curves that rise regularly for an extended period of the lifespan to high levels and decline only moderately at retirement characterize persons in occupations and in countries with opportunities to attain higher living standards. Those that are flatter, lower, more irregular, and decline markedly and earlier in life tend to be associated with poorer persons, in circumstances or lands with much less opportunity.

An advantage of a lifetime income perspective is that it helps to distinguish those inequalities which are largely salutary from those which are not. Thus, inequalities in income associated with differences in age and experience during the prime years of work life are largely salutary. As a person matures and productivity increases during the prime years, his income ought to be higher than when he had fewer years of experience. Moreover, in most circumstances, needs

119

tend to rise as family size increases during the earlier years of maturation of persons and households. There is obviously no sense in trying to correct such sources of inequality in income associated with age.

On the other hand, some declines in income associated with age, such as at retirement, do become social concerns if the declines result in incomes which may be considered too low (too high?) in relation to the person's productive potential, or to general living standards, or in relation to the retired person's past earnings and entitlements.

Most importantly, differences in total lifetime income which arise from differences in the level and time shape of income for different persons are properly objects of social concern if there are many persons for whom lifetime income is uncertain, irregular, and inadequate to meet the changing needs of the main stages of the lifespan. But it should be recognized that as more and more such persons are shifted into higher-paying occupations with lifetime income paths rising more sharply, aggregate inequality due to age will increase and such increases in inequality should not be confused with undesirable sources of inequality.

In the June 1977 issue of the *American Economic Review* extraordinary attention was given to the statistical problem of measuring the effect on inequality in current income arising from differences associated with age. The method adopted by Paglin was severely criticized although everyone recognized the value of Paglin's unusual, if not original, emphasis on the importance of the underlying issue.[1]

This paper is not primarily concerned with the statistical problem of correcting data on current income distributions for income-age differences. It is concerned mainly with the lifetime income perspective itself—with ways of viewing the long-term income path of persons and ways of viewing inequalities in that path as they develop within and among different generations.

Definition and Measurement

A question often raised about lifetime income is how is it to be observed or measured? Is it to be viewed only as the past income of a sample of deceased persons? Does an older generation's income experience foreshadow that of a younger generation? Can lifetime income be viewed by data on age differences in a cross section, or must the changes in income by age be seen only longitudinally over time? In the discussion which follows, data are given on income by age from several sources including cross-sectional and longitudinal data. The different sets of data help put into perspective the relation between life cycle forces that determine or accompany changes in personal income and the institutional and other forces in the economic and social environment that modify the life cycle pattern over time.

We tentatively define lifetime income as income to be expected at a given age, e.g., age 20 or 25, to the end of the work life or, if data are available, to the end of the lifespan. To the extent feasible, estimates are shown in constant prices.

[1] See six papers in that issue by E. R. Nelson; W. R. Johnson; S. Danziger, R. Haveman, and E. Smolensky; J. J. Minarik; C. J. Kurien; and M. Paglin (reply).

A more precise definition on types of income (earnings, property income, transfers) is given later. Numerous measurement requirements need to be met to obtain reliable estimates, particularly for data on the earlier and later years, on income other than earnings, and for the self-employed. Nevertheless, an increasing amount of information on income by age is becoming available from governmental and private survey sources and these data are in fact being used for many practical purposes.

Three Dimensions of Lifetime Income

In the analysis which follows, rates of change in lifetime income were constructed from data in the Current Population Survey of the U.S. Bureau of the Census. The income data, which are before taxes, include money wages or salary; net income from self-employment; income from property and other assets; money transfer payments; private pensions and certain other money payments. Capital gains or sale or withdrawal of assets are not included as income. The data on earnings are considered reasonably reliable, but that on transfers and income from property and other assets of rather poor reliability.[2]

In Chart 1, three views of change or difference in income associated with age are illustrated. This is done by means of two cross sections of mean income by age for 1959 and 1969. The ratio of B to A, shown in the charts, measures the ratio in 1959 of mean income of 35–44 year old men to that of 25–34 year olds. Similar ratios for 1959 could be struck for the other 10-year age spans. Over the full span shown for a single year such as 1959 from age 25–34 to age 65 +, the pattern of change can be taken as the prevailing average age-income structure. A similar, almost parallel structure is shown 10 years later in 1969 but at a higher level. The ratio of C to B measures the age-specific change in income from 1959–69 for the 35–44 age group.
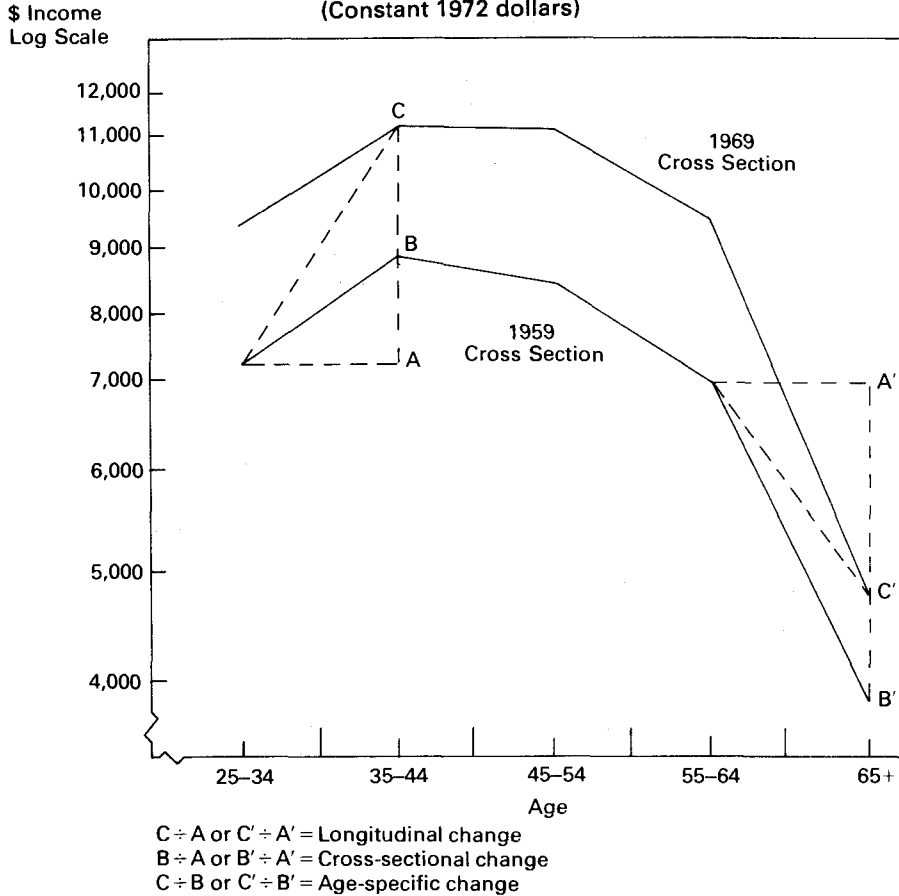
In large part, the growth in the economy, in productivity and wage rates, accounts for the higher levels of income at each age in 1969 compared with 1959.[3] The cohort or longitudinal change is measured by the ratio of C÷A. It combines the age-specific change superimposed, so to speak, on the cross-sectional change. Point C is the income level arrived at in 1969 by the same birth cohort whose income 10 years earlier was at point A. This longitudinal change includes both a life cycle effect and the effect of economic growth and other factors upon the age-specific growth in income. Similar cohort changes over 10-year time spans could be obtained for other 10-year age intervals.

To provide more empirical content to these three dimensions of lifetime income we have averaged the cross-sectional and longitudinal experience for the full period from 1947 to 1972.

[2]Periodic comparisons have been made between income aggregates derivable from the Current Population Survey and from the National Economic Accounts and other sources. For a relatively recent comparison see D. S. Projector and J. Bretz, "The Measurement of Transfer Income in the Current Population Survey", in the *Personal Distribution of Income and Wealth*, J. D. Smith, Editor, National Bureau of Economic Research, 1975.

[3]See Herman Miller, "Lifetime Income and Economic Growth", *American Economic Review*, September 1965. The method shown here differs from that used by Miller for estimating what he has called "economic growth". One should mention at least at this point the debt all students of lifetime income owe to the work of Miller.

121

$ Income
Log Scale

(Constant 1972 dollars)

12,000

11,000

10,000

9,000

8,000

7,000

6,000

5,000

4,000

C

1969
Cross Section

B

1959
Cross Section

A

A'

C'

B'

25–34   35–44   45–54   55–64   65+

Age

C ÷ A or C' ÷ A' = Longitudinal change
B ÷ A or B' ÷ A' = Cross-sectional change
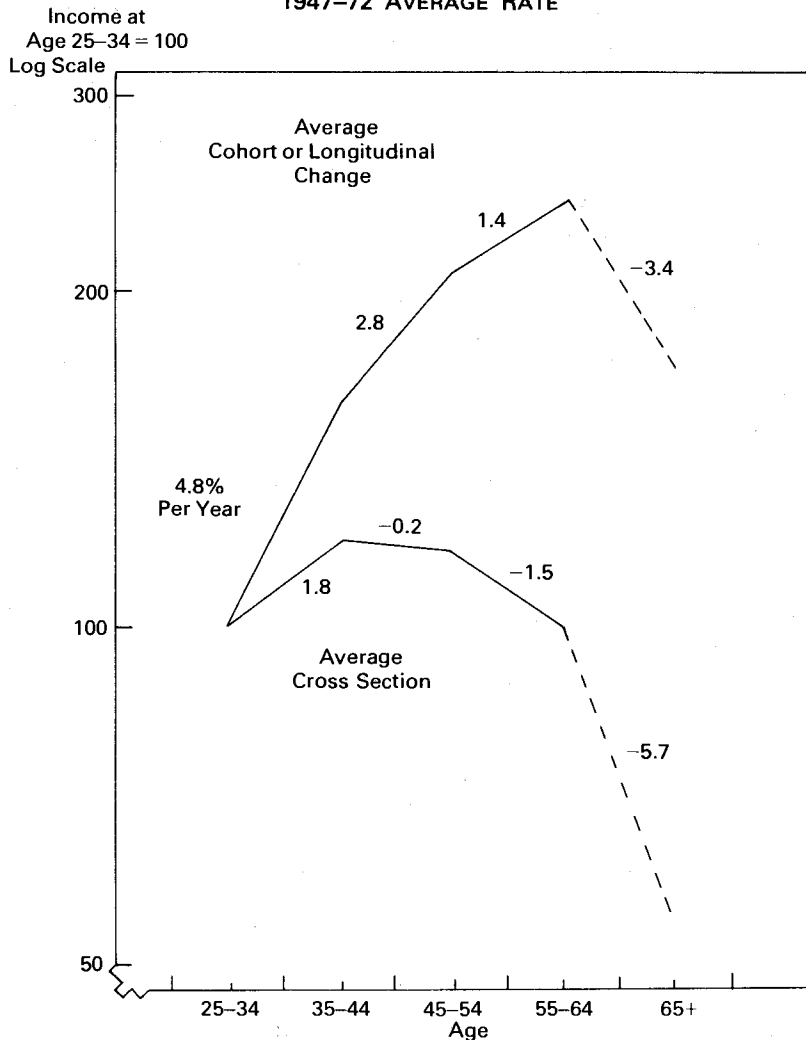C ÷ B or C' ÷ B' = Age-specific change

SOURCE: Current Population Surveys for 1960 and 1970.

An average age-income profile for males in the United States covering the 1947–72 period is shown in Chart 2, both cross-sectionally (lower curve) and longitudinally (upper curve). The lower curve presents percentage ratios of income over successive 10-year intervals based on an average of 25 cross sections for each year from 1947–72. The top curve shows the growth in income over time for an "average cohort." To derive this curve, average percentage changes in real income over 10-year time spans and age intervals, starting in 1947 and at age 25–34, were calculated for 16 cross-sectional pairs. For example, the cohort change over the age interval 25–34 to 35–44 of 4.8 percent per year is an average of cohort changes for that age interval of the 10-year spans 1947–57, 1948–58, and so on to the time span for 1962–72. The same procedure, of course, is followed to obtain the average cohort changes across each of the other 10-year age intervals.

The lower curve shows that mean income for men aged 35–44, at any point in time over the 1947–72 period, averaged 20 percent higher than for men aged

122

Income at
Age 25–34 = 100
Log Scale

Average
Cohort or Longitudinal
Change

1.4

−3.4

2.8

4.8%
Per Year

−0.2

−1.5

1.8

Average
Cross Section

−5.7

300

200

100

50

25–34   35–44   45–54   55–64   65+
Age

SOURCE: Estimates derived from Current Population
Surveys for 1947–64 and 1966–72. See text
for explanation.

25–34. The compound rate in that 10-year age interval is 1.8 percent per year. The upper curve shows that as an average cohort aged during the 1947–72 period over that 10-year interval, mean income rose 60 percent or 4.8 percent per year. The data are in constant prices.

The two curves and their differences (or ratios to one another) summarize broadly the main components of change in lifetime income. The lower curve can be interpreted with some qualification as the age-income profile which reflects the effects of rising individual productivity with age and experience up to the point where productivity peaks and then declines. It is an *estimate* of a static

123

view of the laddered structure of earnings during the prime ages in an economy with no economic or trend change in productivity or other factors which might change the relation between income and age. As the curve shows, income rises on this "static" view at a diminishing rate, peaking at around age 40 and declining rather sharply after retirement. The cross-sectional differences in mean income by age are, of course, imperfect measures of the age income relationship net of changes over time in the economy and in the characteristics of the different age groups or birth cohorts. The averaging of many cross sections tends to reduce the cohort effects.

The top curve is intended to illustrate both the life-cycle effect of income growing at a decreasing rate over the lifespan and the increase in income due to age-specific increases in wage rates resulting from general productivity changes and other factors occurring during the period of a cohort's aging. With the economic growth then prevailing, i.e., 1947 to 1972, average income continued to rise through the life cycle until retirement. Note that the difference between the rate of growth in income of the average cohort and that of the cross section is equal to about 3 percent per year for the prime ages. This is approximately equal to the rate of productivity growth in the economy in the 1947–72 period. If such growth shown by the cohort had not been present, income as measured would have levelled off around age 40 and would have declined more sharply after retirement.

Since the age-specific change is the source of difference between the cohort and cross-sectional profile, which in turn should result from a general rise in productivity over time, some further comparison with productivity data is in order to determine whether the cohort income figures have reasonable validity. Table 1 shows age-specific increases per year in real income over successive 10-year spans compared with several measures of productivity. As the table suggests the productivity changes seem to be quite in line with the age-specific changes in income, although precise quantification is not possible by this rough comparison. Nevertheless, in view of the well known deficiencies in income data from surveys such as the Current Population Survey, it is of some interest to note both the systematic rates of change in the age-specific increases in real income and their broad comparability with the productivity changes.

In addition to general technological change and change in the productivity of capital, the increases over time in age-specific incomes arise from increases in the productivity of labor and in the proportion of higher-paying jobs. Some of the forces underlying the average cohort and cross-sectional changes affect persons in a neutral way while others do so quite differently. Economy-wide change in productivity, a substantial part of the difference between cohort and cross-sectional lifetime income paths, tends to affect persons about equally. On the other hand a host of other factors which influence entry into and economic "success" within a given career (family and ethnic background, sex, measured intelligence, schooling, motivation) combine to result in large individual or group differences in age-income time paths. In the section which follows some orders of magnitude of differences in time paths are presented mainly to highlight several measurement issues.

TABLE 1
AGE-SPECIFIC RATES OF GROWTH IN MEAN ANNUAL INCOME OF MEN
AND IN ECONOMIC PRODUCTIVITY

COMPOUND ANNUAL RATES, CONSTANT 1972 DOLLARS

10-Year Spans	Age-Specific Increases					Productivity Increases	
	25–34	35–44	45–54	55–64	65+	GNP per man-hour	Compensation per employee
1947–57	2.93	2.32	2.22	2.00	−0.007	3.45	3.25
1948–58	3.01	2.57	2.79	2.47	0.67	3.28	3.00
1949–59	3.60	3.96	3.20	4.27	1.35	3.36	3.68
1950–60	3.18	3.03	2.70	2.85	1.50	2.11	3.19
1951–61	2.91	3.09	3.41	3.70	4.01	2.78	2.63
1952–62	2.44	3.82	2.71	2.95	1.57	3.06	2.67
1953–63	2.46	3.07	3.01	3.17	2.01	3.00	2.44
1954–64	3.38	3.43	3.05	3.11	3.59	3.14	3.02
1955–65	N.A.	N.A.	N.A.	N.A.	N.A.	3.02	2.76
1956–66	2.81	2.87	3.07	2.95	1.74	3.42	2.82
1957–67	2.99	3.29	3.32	3.50	3.16	3.33	2.88
1958–68	3.40	3.74	3.52	3.86	3.89	3.36	3.55
1959–69	3.01	3.03	3.47	2.61	2.96	3.00	3.10
1960–70	2.54	2.48	2.92	2.92	2.14	2.93	2.78
1961–71	2.09	2.39	2.71	2.23	1.38	3.00	2.81
1962–72	2.61	2.54	3.19	2.94	2.84	2.90	2.69
1963–73	2.40	2.74	2.71	2.50	3.10	2.55	2.15
1964–74	1.25	1.78	2.24	2.25	1.42	1.89	1.96
Average	2.78	2.96	2.97	2.98	2.22	3.01	2.89

SOURCES: Age-specific increases derived from income data of the Bureau of the Census, *Trends in the Income of Families and Persons in the U. S., 1947–1964,* Technical Paper No. 17, 1967, and Current Population Reports, P-60, Nos. 51, 53, 64, 66, 75, 80, 85, 90, 92, 93 and 101. GNP per man-hour and Compensation per employee derived from data in *1976 Economic Report of the President.*
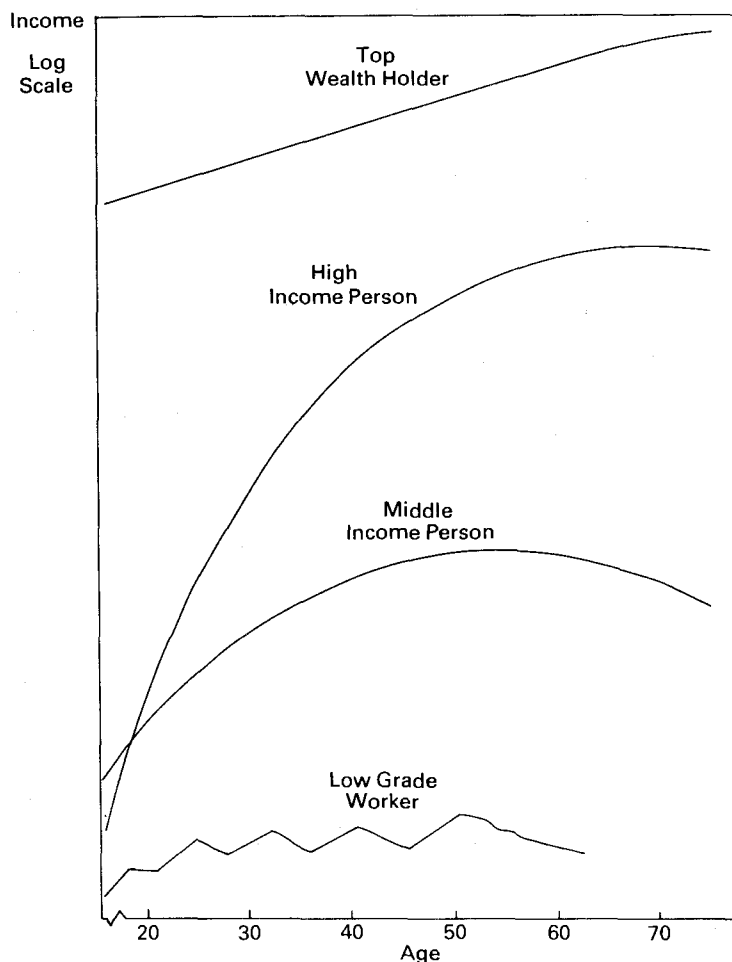
Difference in Lifetime Income Patterns—A Preliminary View

The level and time shape of income differ considerably among persons, as the following sketches illustrate.

The first sketch (Chart 3) illustrates differences in income-age relationships that might be expected over the course of an adult lifetime for different groups. Four broadly defined income groups shown in the chart serve to suggest the wide spectrum in income histories of persons in an economically advanced country such as the United States.

While the most obvious feature of the chart is the difference in levels among the broadly defined groups, another aspect is that incomes rise for each group early in life and then level off or decline except for the topmost wealth holder. For him, a continual rise in income is shown throughout life with some irregularity (shown in chart 4) arising from ups and downs in property income. Significant differences in time shape are illustrated: the higher level curves are shown to rise for a longer period and to decline less at retirement than the lower ones. The lowest is flatter and has much more irregularity than the higher ones.

Income

Log
Scale

Top
Wealth Holder

High
Income Person

Middle
Income Person

Low Grade
Worker

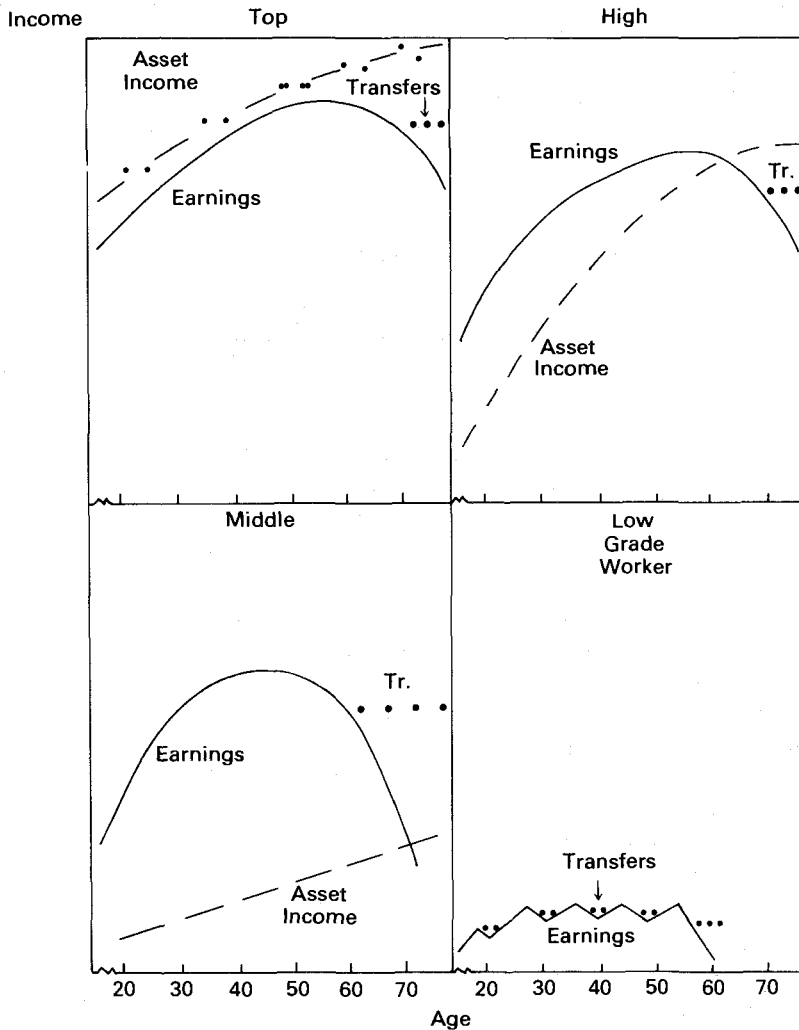20   30   40   50   60   70

Age

The length of the lifespan is somewhat longer on average for the higher than the lowest, which we have attempted to suggest by the different lengths of the solid line of lifetime income. It is not fully clear that the length of *work life* is longer. Higher income persons generally retire later but start their full-time work career later. The net effect is still somewhat undecided, though it is likely that total length of work life, taking into account mortality and unemployment differences, is significantly shorter on the average for the ones with lowest, flattest, and most irregular curves.

Note also that for the high income person at the outset the level of income is shown to be equal to or slightly below the middle income curve, because full entry into the labor force occurs later for persons with longer periods of training.

In the second sketch (Chart 4), each of the curves for each of the broad income groups is detailed to show income by source, with earnings the dominant source for most groups. Transfers, including pensions, are a much more

126

Income

Top

High

Asset
Income

Transfers

Earnings

Earnings

Tr.

Asset
Income

Middle

Low
Grade
Worker

Tr.

Earnings

Asset
Income

Transfers

Earnings

20 30 40 50 60 70   20 30 40 50 60 70

Age

important source, of course, for the lowest than for the higher incomes while property incomes are most dominant in the very highest group. Property income for the higher incomes is shown to rise at a constant rate for most of the lifespan, with some irregularity to be expected for the topmost wealth holders for whom realized capital gains and other types of noninterest or nondividend income are large fractions of total property income.

The lifetime perspective helps distinguish transfer issues from productivity or job opportunity issues. The transfer system is largely concerned with increasing the welfare of the nonworking population: the old, dependent children and parents, the disabled, and of course, the temporarily unemployed. The charts, using lifetime income of *persons,* leave out a sizeable amount of transfers— money and in-kind—which go to *families.* For most transfer issues, the income

127

data ought to be on a family basis, but we do not deal with family income in this paper, even though stage-of-life analysis of family income is pertinent to the general study of lifetime income.

What is significant in the charts, however, is that they place into sharp relief the curves for the very lowest of the income groups for whom the chief problem is one of job opportunity, that is to say, the opportunity to have jobs with long-term income growth characteristic of those in the better-paying occupations.

Two Approches to Measuring Lifetime Income Inequality

We seek to explore an inter- and intracohort framework for analyzing differences in the level and general time shape of lifetime income. Intracohort analysis explores the question of the changing dispersion over the life-cycle of a given generation as it ages. For example, does this variance increase over time or not?

Intercohort analysis seeks, among other things, to determine whether successive generations are experiencing differences in average lifetime patterns of increase or decline during the main stages of life, including retirement.

Intracohort analysis—To present orders of difference among persons in their age-earnings profiles within cohorts, we make use of longitudinal data drawn from a 1-percent annual sample of all employees covered under social security from the Continuous Work History Sample (CWHS).

This file, known as the Longitudinal Employee-Employer Data (LEED) file, Social Security Administration, maintains an annual record of estimated total earnings by age, sex, and race of earner, as well as other information. Data from 1957 to 1969 have been made available for our study. We acknowledge with gratitude the help of Richard Ruggles in making his copy of this file available to us and for his counsel in the use of this file.[4]

In Chart 5, *mean* earnings profiles are presented for four birth cohorts, by race and sex within each cohort. The panels go from the youngest cohort born in 1932 to the oldest born in 1902. Data cover the years 1957 to 1969 for each cohort; the youngest, covering ages 25 to 37; and the oldest, 55 to 67.

Over the 1957–69 period shown in these charts, the large differences in earnings between the race and sex group levels generally persist through time in each of the cohorts. Broadly, therefore, the time shape of the *mean* age-earnings profiles for the different groups tended to be parallel in each of the cohorts. For nonwhite males much more irregularity is evident in each cohort than for other groups.
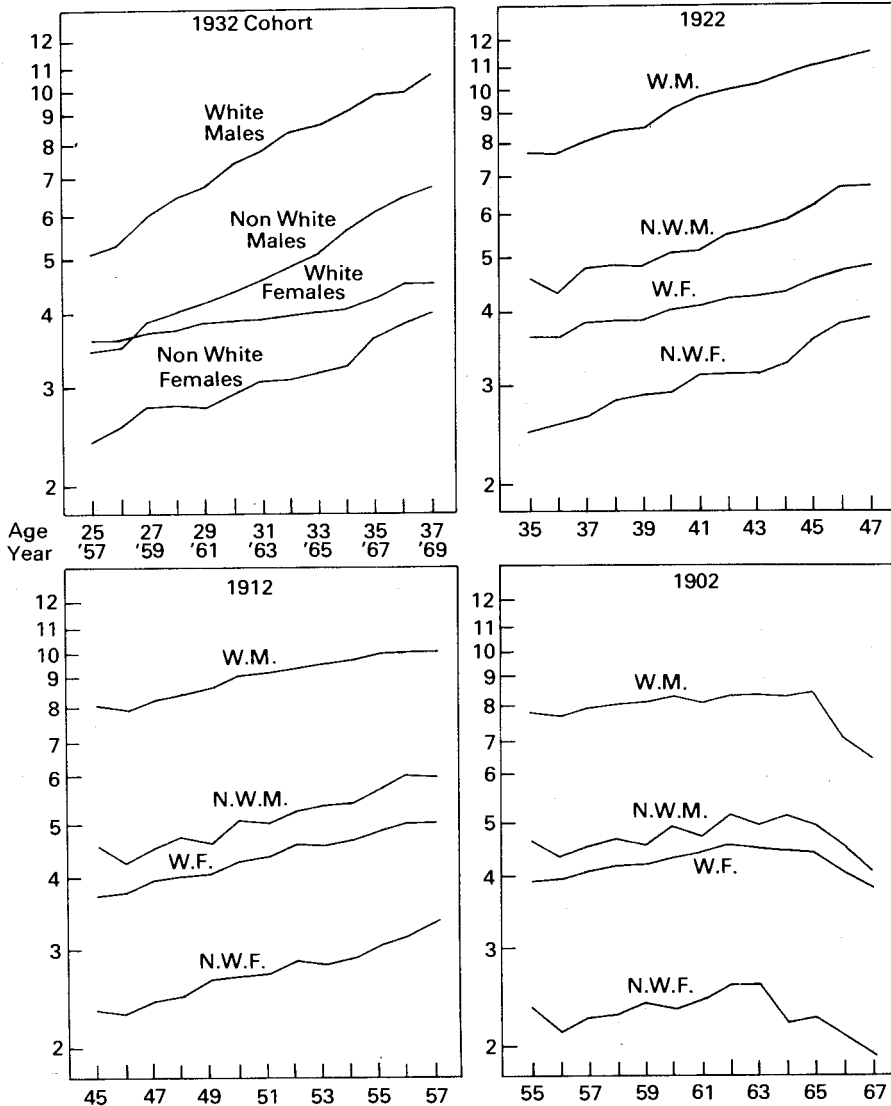
In the 1932 cohort, earnings of white women show a marked relative decline to other groups. The data seem to imply that each new wave of entries of women between 1957 and 1966 or between the ages of 25 and 35 (when most of the relative decline occurred) received earnings below the mean for all women, the exits and entries occurring as women left to have children or returned after child bearing. The relative decline for white women is evident also for those who

[4]See also N. and R. Ruggles, "The Anatomy of Earnings" in *Economic Well Being*, F. T. Juster, Editor, published for the National Bureau of Economic Research by Balinger Publishing Co., Cambridge, Mass., 1977.

(Constant 1972 dollars)

Log Scale
$ Earnings ('000s)

SOURCE: LEED file.

were employed in both 1959 and 1969 in this cohort, although to a much less degree.

The above chart presented *mean* earnings profiles which suggested little difference in the time shape of the profiles and, by implication, a persistence of annual differences in income over time within a given generation as it ages.

129

TABLE 2

INEQUALITY OF EARNINGS FOR FOUR COHORTS BY RACE AND SEX

COEFFICIENTS OF VARIATION IN 1959 AND 1969

Cohort	White Males		White Females		Nonwhite Males		Nonwhite Females	
	1959	1969	1959	1969	1959	1969	1959	1969
1925–29	0.59	0.72	0.76	0.69	0.66	0.62	0.82	0.70
1920–24	0.67	0.75	0.75	0.64	0.65	0.61	0.80	0.78
1915–19	0.73	0.78	0.69	0.64	0.67	0.65	0.80	0.75
1910–14	0.78	0.81	0.69	0.66	0.64	0.62	0.75	0.76

SOURCE: Derived from LEED File.

However, variance around these means suggests a somewhat different outcome, as Table 2 shows.

Table 2 presents coefficients of variation in earnings for broadly similar cohorts as in the previous chart, but for two points in time: 1959 and 1969. What the table basically says is that earnings inequality is shown to increase over time for white males but not for others—in the 10-year span recorded in the table. For white males every cohort from the youngest to the oldest showed a higher coefficient of variation in 1969 earnings than in its 1959 earnings. The rate of increase, however, slowed down at later stages of life as shown by the coefficients for the older cohorts. This measure of variance increased for the 1925–29 cohort (aging from 30–34 to 40–44) from 0.59 in 1959 to 0.72 in 1969 or by 22 percent. For the oldest cohort shown, although the level of variance was higher, the increase from 0.78 to 0.81 was only 4 percent. For groups of persons other than white males, variance within those groups showed little or no change from 1959 to 1969. In fact, *declines* in variance were evident for the younger cohorts.

We pursue further the phenomenon of increasing inequality over time within a given generation of white males. Table 3 shows additional detail for the 1925–29 cohort of white males which had been discussed earlier. In the table, the members of this cohort are cross-classified by their earnings decile in both 1959 and 1969, forming a transition matrix. Of the 2.3 percent of this cohort (total of the first row) who were in the lowest decile in 1959, 0.4 (intersection of first row and first column) remained in that decile in 1969.

About two-thirds of this cohort changed their decile position, 47 percent moving from lower to higher deciles, while 20 percent moved downward (Table 4). Of the third of the cohort which remained in the same decile, some of course, moved up or down within the income limits of their decile.

Some features of relative movement are made more evident particularly for the fraction of white males who move into the 10th decile. Note that for each cohort, the percentage moving into the 10th decile ("arrivers") is far higher for white males than for the others.

The higher fraction of "stayers" as a v. nole, i.e., in any decile, shown for white males, reflects the fact that a much higher percentage were already at the 10th decile and remained there in this period of vigorous economic expansion.

130

TABLE 3
PERCENTAGE DISTRIBUTION OF WHITE MALE EARNERS
BY THEIR 1959 AND 1969 DECILE POSITION
1925–1929 COHORT

1959 Deciles	1969 Deciles											Mean Income in 1959
	1	2	3	4	5	6	7	8	9	10	Tot.	
1	0.4	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	2.3	$126
·2	0.2	0.2	0.3	0.3	0.2	0.3	0.3	0.3	0.2	0.2	2.6	520
3	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.3	0.3	3.2	1,038
4	0.2	0.2	0.2	0.4	0.4	0.5	0.7	0.6	0.5	0.4	4.1	1,653
5	0.2	0.2	0.2	0.3	0.5	0.9	1.2	0.8	0.7	0.5	5.4	2,380
6	0.2	0.2	0.3	0.4	0.5	1.2	2.3	2.1	1.6	1.0	9.7	3,134
7	0.2	0.2	0.2	0.3	0.4	0.8	2.1	3.1	2.8	1.5	11.5	4,002
8	0.2	0.2	0.2	0.2	0.3	0.5	1.5	4.2	5.5	3.6	16.4	4,875
9	0.2	0.2	0.1	0.2	0.3	0.4	1.1	2.9	8.2	9.9	23.5	6,036
10	0.1	0.1	0.1	0.1	0.2	0.2	0.4	1.1	3.1	15.9	21.3	9,062
Total	2.0	1.8	2.1	2.7	3.3	5.3	10.1	15.7	23.2	33.7	100.0	5,162
Mean in 1969	$187	716	1,450	2,397	3,482	4,607	5,933	7,477	9,438	16,478	9,991	N = 37,688

	$\bar{X}$	σ	$\sigma/\bar{X}$
1959	$5,162	$3,062	0.59
1969	$9,991	$7,152	0.72

Note: The percentages in the 1959 and 1969 margins do not distribute by tenths mainly because the decile distributions were constructed for the total of all sex, race and cohort groups. Mean incomes in current dollars.

SOURCE: Constructed from LEED file.

For example, about 21 percent were already in the 10th decile in 1959 in the 1925–29 cohort (Table 3). When the percentage *remaining* in the 10th decile is subtracted from the total for all stayers, white men show much more mobility than for the other groups. Of those who were "stayers" by the definitions of this exercise, most had increases in dollar incomes and moved into the higher limits of the topmost decile between 1959 and 1969. Evidently, white males within each of the generations studied and in the 1959–69 period moved with greater frequency into the highest deciles and into the higher reaches of those topmost deciles than did the other groups.

TABLE 4

PERCENTAGE DISTRIBUTION OF EARNERS
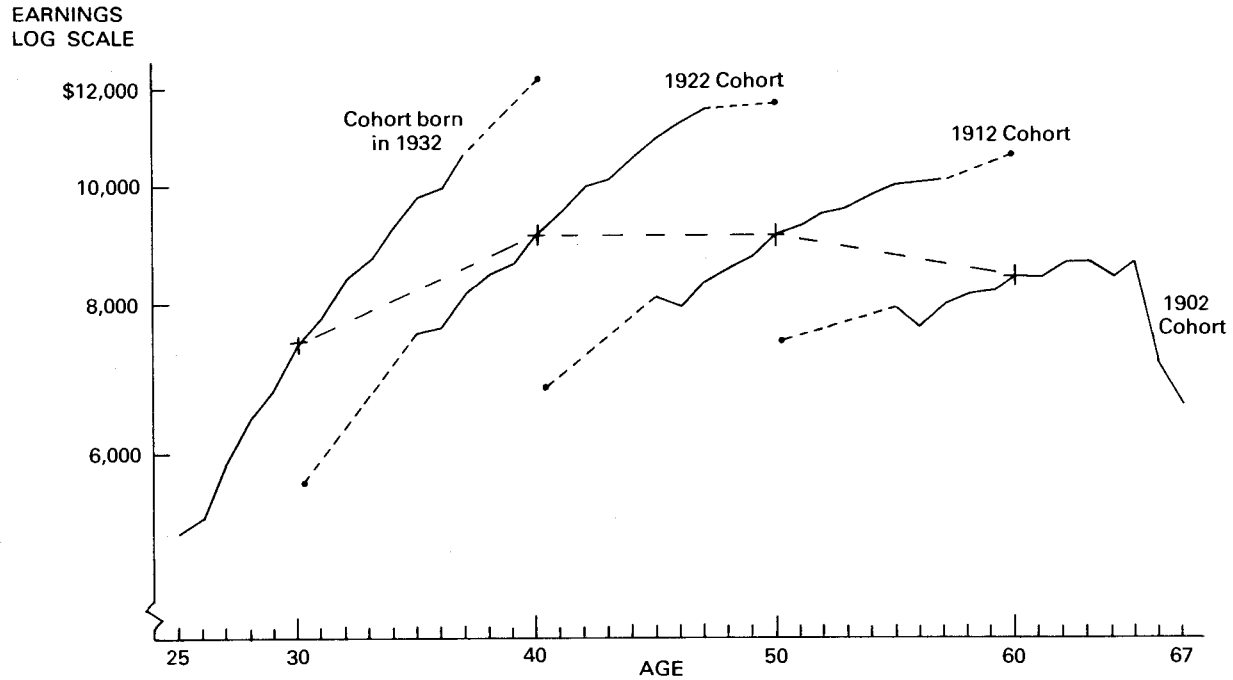BY CATEGORY OF MOBILITY—1959 TO 1969
FOUR COHORTS BY RACE AND SEX

Cohort	Total	"Stayers"	"Movers"			10th Decile	
			Total	Up	Down	"Stayers"	"Arrivers"
White Males							
1925–29	100.0	33.4	66.7	47.0	19.7	15.9	17.8
1920–24	100.0	39.2	60.8	38.4	22.4	20.4	13.0
1915–19	100.0	40.1	59.9	33.0	26.9	19.6	9.4
1910–14	100.0	38.8	61.2	25.9	35.3	17.2	6.8
White Females							
1925–29	100.0	20.7	79.3	58.3	21.0	0.5	2.1
1920–24	100.0	23.1	76.9	58.7	18.2	0.5	1.9
1915–19	100.0	25.6	74.4	51.0	23.4	0.7	1.8
1910–14	100.0	27.9	72.1	46.4	25.7	0.9	2.1
Nonwhites Males							
1925–29	100.0	20.1	79.9	60.3	19.6	1.9	6.9
1920–24	100.0	23.5	76.5	54.3	22.2	2.5	5.6
1915–19	100.0	24.5	75.5	51.4	24.1	2.2	4.7
1910–14	100.0	27.8	72.2	47.2	25.0	1.9	3.9
Nonwhite Females							
1925–29	100.0	16.6	83.4	67.2	16.2	0.1	1.2
1920–24	100.0	21.8	78.2	61.0	17.2	0.3	1.5
1915–19	100.0	25.3	74.7	53.4	21.3	0.2	1.0
1910–14	100.0	29.3	70.7	49.1	21.6	0.0	0.7

SOURCE: Derived from LEED File.

Intercohort analysis—In the intracohort analysis above, we sought to determine how differences in earnings among members of a cohort develop over time as a given cohort passes through its main stages of life. With intercohort analysis, we seek to determine whether the cohorts differ from one another in comparable stages of their lives. For example, are young students today earning more or less from part-time work than their counterparts 10 or more years ago? Are the "baby boom" cohorts experiencing slower rates of growth in income because of their greater numbers? To what degree has the time path of earnings of women risen more rapidly during their prime ages than in the past when their time paths were much flatter than for men?

While we do not seek in this paper to answer these questions, we do present in the next chart, for brief discussion, a mode for constructing time series with which to answer such questions. One basic point of the chart is to illustrate how longitudinal time series may be constructed from available data for different cohorts, covering fairly extensive portions of the lifespan. Thus, in Chart 6, data are presented for four cohorts spaced 10 years apart, starting with the youngest, born in 1932. For that youngest cohort, income and/or earnings data are shown from age 25 to age 40, or from 1957 to 1972. For the next oldest cohort born in

CHART 6: MEAN ANNUAL EARNINGS FOR FOUR
COHORTS OF WHITE MEN
(Constant 1972 dollars)

EARNINGS
LOG SCALE

$12,000

10,000

8,000

6,000

Cohort born
in 1932

1922 Cohort

1912 Cohort

1902
Cohort

25   30   40   AGE   50   60   67

SOURCE: Solid lines, LEED file; dotted lines based on Current Population Survey P-60 Series.   Dashed line
connecting crosses represents 1962 cross section.

1922, income or earnings data are shown from age 30 to age 50, or from 1952 to 1972.

The key analytical feature of the chart is the extent to which intercohort comparisons can be made *for comparable stages of life*. For example, the 1932 and 1922 cohorts each have data shown for the span between age 30 and age 40. Does the 1932 cohort income path in the 1962–72 period differ from the 1922 cohort income path in 1952–62? With these rather rough figures, it would appear that the time shape in the logarithms is about the same for the two cohorts. The difference in level largely reflects the increase in age-specific wage rates between the two decades. Similar comparisons, but for later life stages, e.g., ages 40 to 50 for the 1922 and 1912 cohorts, also suggest little change in the time shape of lifetime incomes. Data since 1972, not shown in the chart, suggest that the slowdown in economic growth, if long run, will lessen the rate of income for younger cohorts in their early years and the older cohorts in their later years.

The data in the chart are constructed from two sources. The solid lines for each cohort are based on earnings data from the work history longitudinal data set of the Social Security Administration, described earlier. The dotted lines for each cohort are extrapolations forward or backward based on percentage changes in cohort incomes of broadly comparable age groups in the Current Population Survey of the Bureau of the Census. As a progress report, it may be mentioned that time series for additional cohorts and covering earlier stages of life than age 25 are being constructed in our ongoing research using more of the longitudinal data of the Social Security Administration and of other sources of longitudinal data.

The cohort time series presented above dealt with a few of the measurement issues in analyzing income change and its inequality over the life cycle and over time.[5] Before concluding this article we mention some recent discussions of relevance of such data for long-term equity issues.

Is Lifetime Income More Equally Distributed Than Current Income?

On the face of it the answer would seem to be "yes, more equally distributed," on three counts: First, differences due to age in current income are eliminated in the use of lifetime income; second, a total or average over many observations is much more likely to have less variance than for a given point in time; third, the higher lifetime incomes reaching their peaks later in life, when discounted to a present value early in life, lose a sizeable part of this advantage.

A recent study in fact found that the inequality in lifetime earnings which the author called "human wealth" was 50 percent larger than in current earnings as measured either by the coefficient of variation or the Gini coefficient.[6] But the sample for this study had virtually no coverage of the lowest income groups, as

[5]Among the several antecedent efforts to this type of analysis see Martin David, "Time-Series versus Cross-Section Lifetime Earnings Patterns in Different Occupational Groups", *Proceedings* of the Business and Economics Section of the American Statistical Association, Dec. 1969. See also article by Martin David and Roger Miller in *Review of Income and Wealth*, March 1970.

[6]L. A. Lillard, "Inequality: Earnings vs. Human Wealth", *The American Economic Review*, March 1977. Based on a panel study of ex World War II Air Force cadets, covering their earnings for the year 1955, 1960, 1964, and 1968.

the author recognizes. The author of this excellent article was only peripherally interested in the question of total variance for the general population in lifetime income. Nevertheless, variance in lifetime earnings is understated in that study mainly because of two reasons discussed below.

The first concerns differential mortality affecting particularly the lowest income groups whose age-specific mortality rates are significantly higher than for others in the population during their working years of lifetime income. Differences in total lifetime income arising from differences in length of life were not considered in this study, in part perhaps because of no representation of the very low end of the income distribution.

The second consideration concerns discounting, a most vexing question in evaluating differences in lifetime income. In the aforementioned study, discount rates entered the analysis but not in a manner that would apply different discount rates to the various persons in the panel. A choice of discount rates was applied uniformly to all members. This mode of variation in discount rates served only to decrease variation in the present value of lifetime income arising from those lifetime incomes ((generally the higher ones) which reached their peaks later in life. But a sizeable variation in the discounted value of lifetime incomes arises from differences among the individual members themselves in discount rates.

I conjecture that discount rates vary widely. I say "conjecture" because data are not clearly available to validate this belief. My conjecture is based on two considerations. Market rates of interest vary considerably among borrowers of different incomes and education levels, particularly for consumer installment loans, but also mortgage loans. Secondly, the fact that the saving rate varies widely by age and income group itself suggests, if not implies, a difference in the rate at which different persons value future income.

I further conjecture that when these two considerations—differential mortality and differential discount rates—are taken into account, their effect on inequality of lifetime income within a middle and upper-income range may not be large. But between the lowest and other incomes, allowing for these factors may significantly increase the measure of inequality in lifetime income.

For the purposes of this paper, a rough notion of the effect on measured inequality of adjusting for differential mortality and discount rates is obtainable from data on mean lifetime incomes.[7] In 1972, according to this source, a man with less than an elementary school education could expect a mean "lifetime" income at age 18 and until age 64 of $248,000. A man with 4 years or more of college could expect an income of $648,00 or 2.6 times that of the much less educated man. These figures incorporate the *same* average mortality experience of males for the two education groups. Economic growth and the discount rate are assumed to be zero. However, if we adjust these figures for differential mortality (using differentials by race and education)[8] and discount rates (7

[7]U.S. Bureau of the Census, "Annual Mean Income, Lifetime Income, and Educational Attainment of Men in the United States, for Selected Years, 1956 to 1972". Series P-60, No. 92, March 1974, Table 9.

[8]Based on the data from E. M. Kitagawa and P. M. Hauser, *Differential Mortality in the United States,* Cambridge, Mass., Harvard Press, 1973; and *Vital Statistics of the United States, 1970,* Vol. II–Section 5, "Life Tables", Table 5–3, p. 5–11, for white males and "all other" males.

135

percent for the poorly educated and 3 percent for the highly educated man), the figures become $63,000 and $316,000, respectively, as the "present" value of expected lifetime income at age 18. With these adjustments the multiple has increased from 2.6 times to 5.0 times. If a positive rate of economic growth is included, the effect of mortality differences further amplifies the difference as a consequence of the rise in the relative importance in total lifetime income earned at later ages. Of course, these adjustments are crude and a much more careful job is needed which we plan to do in our later research. But they do serve to indicate that for a lifetime view of the relation between the lower and upper ends of the income distribution, consideration of mortality and discount rate differences is requisite.

Differences in expected length of life and in the rate at which the value of future income is discounted have an important bearing on the determination of the long-term equity of the Federal tax and Social Security system. Persons pay a lifetime of taxes and receive a lifetime of benefits. Is the net benefit regressive or progressive? In the case of social security, for example, is the sharply regressive effect of the payroll tax overcome by the highly progressive benefit structure? The answer to this question is still unclear.

The relative burden of income and social security taxes is increased to the extent that the expected length of life of earnings plus retirement is relatively short and the rate at which future income is discounted is relatively high. Or put differently, what fraction of a birth cohort of low-income workers survive to the period of retirement and through an extended period of benefit payments? And for those low-income workers, what is the opportunity cost of the payroll taxes they pay given the rate at which they value their future income?

According to one study of this matter the rate of return of benefits over taxes paid according to a sample of case histories of workers retiring between 1967 and 1970 was very much higher for the low-income retirees than for the high. On a lifetime basis the sharply regressive feature of the payroll tax was more than overcome by the highly progressive feature of the benefit structure, according to this study.[9]

However, at this stage of the art of lifetime income analysis, it is probably fair to say that the issue of long run equity of the Social Security system is still open to question. See, for example, another study which found that currently the regressive payroll tax will outweigh the benefit side and the U.S. Social Security system will be regressive on a lifetime basis for future retirees.[10]

More adequate estimates of lifetime income and proper allowance for mortality and discount rate differentials are needed to resolve these issues to which we hope to contribute in our ongoing research.

[9] A. Freiden, D. Leimer, and R. Hoffman, "Internal Rates of Return to Retired Worker Only Beneficiaries Under Social Security, 1967–70", U.S. Social Security Administration, Publication No. 77-117776, Oct. 1976.

[10] H. Aaron, "Demographic Effects on the Equity of Social Security Benefits", in Feldstein, M. F. and Inman, R. P.., Eds., Economics of Public Services, Macmillan, London, 1977.